OPTIONS for

ENERGY EFFICIENCY in EXISTING BUILDINGS

STAFF DRAFT REPORT

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EXECUTIVE SUMMARY

AB 549 (Longville), Chapter 905, Statutes of 2001, directs the California Energy Commission to "investigate options and develop a plan to decrease wasteful peak-load energy consumption in existing residential and nonresidential buildings" and report its findings to the legislature. The Energy Commission's initial response to this legislation was the report, *Assessing the Energy Savings Potential in California's Existing Buildings: An Interim Report to the Legislature in Response to AB 549* (December, 2003 Energy Commission Report #400-03-023F). The following staff draft is based in part upon the interim work, but primarily represents additional research efforts conducted since that time[1].

Improving the energy efficiency of buildings has been a long term effort at the Energy Commission. Statewide building energy efficiency requirements are adopted in Title 24, Part 6, of the California Code of Regulations. These Building Energy Efficiency Standards (Building Standards) apply to both residential and nonresidential buildings. The Building Standards were first put into effect in 1978, in response to the Warren-Alquist Act's mandate to reduce California's energy consumption. They require the use of energy efficiency measures in newly constructed buildings and in additions to, and alterations of, existing buildings. They are enforced by local building departments. Every three years, except when emergency proceedings are called for, the Building Standards incorporate new energy efficiency technologies and methods of installation.

The Energy Commission also adopts Appliance Energy Efficiency Standards (Appliance Standards) in Title 20. The Appliance Standards apply to a large number of appliance and equipment categories. The first Appliance Standards were put into effect in 1977, and they are periodically updated to add appliance types and/or raise efficiency levels. The Appliance Standards require the manufacture of energy efficient appliances and equipment and make it unlawful for anyone to sell in California appliances that fail to comply. The Appliance Standards thus save energy in both newly constructed and existing buildings.

It is estimated that the Building and Appliance Standards together have saved more than $36 billion in electricity and natural gas costs in excess of the costs to comply since 1978. They will save an additional $43 billion by 2013.

[1] An advisory committee consisting Pacific Gas and Electric Company, Southern California Edison, Sempra Utilities, and the California Public Utilities Commission provided guidance for this project.

The latest revisions to the Building Standards were adopted in 2003 and go into effect October 1, 2005. The latest revisions to the Appliance Standards were adopted in 2004 and go into effect on staggered dates beginning on January 1, 2006.

In examining the potential for further improvements in existing buildings, it is important to first consider the type and age of California's existing building stock. As shown below, the residential building stock is primarily single-family units occupied by the owner. About 73 percent of these homes were built prior to the 1982 version (second generation) Building Standards. Multi-family homes represent the balance of the residential stock; about 75 percent of those units were again built prior to the 1982 Standards.

Residential Building Stock

	Single-Family Dwelling Units		Multifamily Buildings	
	Units Added	Total Units	Units Added	Total Units
pre-1982		5,554,290		2,723,422
1982-1991	1,080,354	6,634,644	610,900	3,334,322
1992-2000	720,714	7,355,358	216,720	3,551,042
2001-current	193,220	7,548,578	73,577	3,624,619

Source: California Energy Commission, 2003 Forecast Data for Residential Buildings.

California's nonresidential building stock is much more diverse and is usually expressed in millions of square feet of floor area. The table below shows that about 58 percent of nonresidential buildings were built before the 1978 Building Standards. Large offices, retail and non-refrigerated warehouses represent approximately half of the total nonresidential building stock. These data indicate that the potential for further energy savings in existing buildings, whether residential or nonresidential, is significant.

Percent of Nonresidential Floor Stock Area (MILLIONS FT^2) Built Prior to 1978

Year	pre-1978	Current Stock	% of Stock
Small Office	191.4	347.7	55%
Restaurant	94.3	149.5	63%
Retail	519.8	897.5	58%
Food Store	140.3	233.4	60%
Non-Refrigerated Warehouse	383.2	762.3	50%
Refrigerated Warehouse	23.8	45.2	53%
School	361.4	453.0	80%
University	201.3	277.1	73%
Hospital	153.3	280.5	55%
Hotel	140.9	269.0	52%
Other	610.5	1,007.7	61%
Large Office	523.1	1,033.3	51%
Total	**3,343.4**	**5,756.2**	**58%**

* California Energy Commission, 2003 Forecast Data for Nonresidential Buildings.

In developing strategies to further improve the energy efficiency of existing buildings, the Energy Commission, through its technical consultants, conducted literature reviews, program manager interviews, key informant interviews, and expert panel discussions; solicited public comment, and analyzed consumer-opinion survey and appliance saturation-survey data. Market barriers to adopting energy efficient technologies were explored, as well as research into consumer behavior and other market participant motivations.

From these discussions and this research, 16 strategies were identified for the AB 549 project. More detailed discussions of the approaches used, and the feedback received from interviewees, can be found in two consultant reports posted on the Energy Commission's AB 549 website.[2]

Of these 16 strategies, nine represent the portfolio of priority initiatives recommended by staff and are listed in order of decreasing electricity savings. In staff's view, four of the remaining seven strategies deserve further consideration, but are not recommended as immediate priorities at this time. The remaining three strategies are not proposed for further consideration because they offer uncertain energy savings or more limited value, compared to recommended strategies.

Recommended strategies are presented in the table that follows, but all strategies are summarized below. The energy savings were determined separately for each strategy to avoid double counting or overlap.

Recommended Portfolio of Priority Strategies

The costs and benefits of half of the sixteen strategies examined could be quantified by our technical assistance consultants. The following table presents the benefits and costs for these recommended priority strategies. Chapters 1 and 3 provide more detail on the cost effectiveness analysis.

[2] The report titles are: *Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings* (publication number CEC-400-2005-011-D) and *Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings, Appendices* (publication number CEC-400-2005-011-D-AP).

Annual Energy Savings Potential and Cost-Effectiveness

Strategy	Gigawatt hours	Megawatts	Million therms	Program Cost ($million)	Participant Benefit Cost Ratio	Total Resource Cost Benefit Cost Ratio
Information to All Homeowners	66.9	22.5	6.2	50.7	1.95	0.83
Disclosure of Residential Time-of-Sale Home Energy Ratings	59.9	13.0	4.3	16.4	2.9	1.2
Residential Whole Building Diagnostic Testing	58.4	57.3	2.8	23.8	1.1	0.6
Commercial Building Retro-commissioning	52.4	25.9	4.2	22.6	3.8	1.7
Commercial Building Benchmarking	26.1	5.6	0.4	1.9	2.5	1.1
Low Income Multifamily Housing	16.2	26.3	2.3	26.6	3.0	1.3
Residential Equipment Tune-up	15.3	19.5	3.6	NA	2.0	1.3
Energy Efficient Commercial Leasing	4.0	0.8	0.0	0.7	4.6	1.9
Demand Response*	NA	NA	NA	NA	NA	NA
Total	299.2	170.9	23.8	142.7		

* Potential savings for demand response are high, but not quantified for this report.

For comparison purposes, the 2005 Building Standards requirements that apply to additions and alterations to existing buildings are estimated to save 216 gigawatt hours and 71 megawatts in the first year of full compliance.[3]

Information to All Homeowners

This strategy is based on the premise that targeted information, effectively designed, can be powerful in motivating homeowners to continuously save energy by adjusting behavior and making previously unplanned improvements to their homes. Information provided through a central clearinghouse would refer customers to applicable programs and services, to aid and motivate the homeowner to take action. The clearinghouse portal functions as an education and referral service directing homeowners and property managers to energy efficient technology information and services, including in-depth online energy audits and referrals to existing energy efficiency programs. While designed to apply to any homeowner, the strategy would be most effective by targeting homeowners with higher-than-average utility bills, regardless of the year their home was constructed. Customers would receive feedback on their energy consumption, compared to like customers, through utility websites or mailings. By providing homeowners with information on how their bills compare to others with similar homes, they would be motivated to seek more information and take advantage of options available to them to improve the efficiency of their home. Features of the strategy

[3] *Energy Savings Opportunities for Existing Buildings, An AB 549 Final Project Report*, Southern California Edison, February 17, 2004, Heschong Mahone Group, Inc.

include enhancing the utilities' existing online energy audit services, providing easy access to financing, and expanding energy efficiency marketing.

The "Information to All Homeowners" strategy would cost approximately $51 million and save 67 gigawatt hours of electricity. It should be implemented by each of the utility administrators of the Public Goods Charge (PGC)-funded programs.

Disclosure of Residential Time of Sale Home Energy Ratings

When homes, both single-family and multi-family, are offered for sale, their energy efficient features and the potential to cost-effectively reduce energy use in them are material facts that should be disclosed to home purchasers, lenders and appraisers.[4] However, currently this information is not systematically determined and disclosed. Providing home energy ratings, including a cost effectiveness analysis of specific desirable upgrades of the home's energy features, should be done and disclosed. The rating could be performed at listing or before and would be disclosed by realtors at the time of sale. The energy rating would help potential purchasers understand the overall affordability of the home and provide comparative energy consumption and efficiency information to the buyer. The rating report would include a list of cost-effective energy upgrades that could be pursued if the buyer so chooses, information on energy improvement financing, and referrals to energy incentives that are available. The historical energy consumption of these homes and the energy rating would be disclosed as material facts during the sales process.

In California, over 600,000 existing homes are sold each year (triple the number of new homes built) in California with little consideration for improving the efficiency of these buildings at the time of ownership change. Unquestionably, the condition of the energy-using features of the home and the potential to upgrade them to avoid excessive energy bills are facts that would materially affect the value or desirability of the property. Buyers of the property need to be informed of the condition of its energy using features, and provided with voluntary, cost-effective options for improving energy efficiency. For the information to be valuable, an independent assessment (rating) of the building efficiency is essential. Coupling the rating information with available incentives and efficiency improvement mortgage products would encourage buyers to take action.

Training realtors on home energy ratings and their disclosure is important to make this strategy a success. As recommended by the California Building Industry Association, homes built before the 1982 Building Standards should be targeted initially to gain the largest possible reductions in energy use. The rating industry would also need to be expanded, adding raters to meet the increase in demand that would be created by this

[4] Section 2079.16 of the California Civil Code requires realtors to disclose certain information. It says, "Seller's agent or a subagent of that agent has the following affirmative obligations: (c) A duty to disclose all facts known to the agent materially affecting the value or desirability of the property that are not known to, or within the diligent attention and observation of, the parties."

strategy. Data on the age of properties sold annually must be known to help quantify the demand for raters. If property sales are evenly distributed across the age of the housing stock, then up to 450,000 homes per year would receive ratings (75 percent of all homes sold). Assuming a rater could perform two ratings per day, or 500 per year, then 900 raters would be required to meet the demand. Staff expects that the disclosure strategy would not be able to take place for approximately two years, to allow for completion of an Energy Commission HERS proceeding and to train the additional raters. Subsequent phases of this strategy would target homes built in 1982 and later.

The program's cost of $16.4 million would be paid for by property sellers or buyers, depending upon the negotiated home sales agreement. If the buyer incurs the cost and decides to pursue efficiency upgrades, the rating expense could be included in an Energy Improvement Mortgage. Annual energy savings of 60 gigawatt hours and 13 megawatts are estimated. PGC-funded incentives and information programs should be provided to support the phase-in of ratings.

Residential Whole Building Diagnostic Testing

Whole-building diagnostic testing is a process to systematically detect flaws in building construction or operation, diagnose their causes, and facilitate, enable and verify their correction. Climate, building materials, mechanical equipment design and installation, and the actions of the building's occupants must all be considered to evaluate a building's performance problems. A trained contractor performs the diagnostic testing, implements the upgrades, and verifies performance in a systematic process. Occupant comfort, safety, and building energy efficiency are improved in the process, and costs may be reduced because of interactive effects (e.g., a smaller HVAC unit may be needed because of other system corrections made by the contractor).

Due to the comprehensive nature of the whole building approach, it is more costly than efforts that focus on only a single energy efficiency measure. The higher cost of the whole building approach may not be cost effective strictly through reduced energy bills, except for high energy users. However, homeowners needing whole-building testing often find it very valuable and worth the cost due to the non-energy benefits that are realized. For many of California's 5.6 million older single family homes built prior to 1982, whole building diagnostic testing offers the potential for significant energy and demand savings, in addition to non-energy benefits. These homes would be targeted in this strategy.

One barrier to implementing this strategy is the lack of qualified contractors to perform the work and, limited training opportunities to prepare them. The California Building Performance Contractors Association currently conducts whole building system training, which involves four days of classroom education and two days of field work. About 100 contractors have been trained to use the whole building approach so far, but many more

would be needed to implement this strategy in response to increased demand once consumers are educated on its benefits.

The program's cost of $23.8 million would be paid for by property owners. Annual energy savings of 58 gigawatt hours and 57 megawatts are estimated.

Commercial Building Retro-commissioning

This strategy promotes services that detect and diagnose faults in commercial building systems operations, and corrects them. The retro-commissioning process systematically investigates the operation of the building's energy consuming equipment. Retro-commissioning is a logical next step after benchmarking, and typically results in both low-cost upgrades to building operations and replacement of failed components. It can also recommend larger capital improvements and equipment replacements. Buildings with lower benchmarking scores would be targeted under this strategy, regardless of the year of construction.

Currently, the demand for retro-commissioning services in California is weak. Even though retro-commissioning is considered one of the more cost-effective options by efficiency experts, commercial building owners remain skeptical of its value and can be slow to initiate a retro-commissioning project. Incentives are needed to increase market demand. At the same time, the industry that provides retro-commissioning services will need to be built up. Retro-commissioning will need more providers as incentives for building owners become available. Training commissioning service providers is a key element of this strategy.

Risk management is an important operating principle for many companies. Retro-commissioning of buildings helps control risk from volatile energy costs as well as loss of tenants due to comfort issues and risks of litigation stemming from indoor air quality problems. Viewing retro-commissioning as a risk management, rather than strictly an energy savings tool, may cause the service to have greater value to commercial building owners and managers.

A final element of the strategy involves education through case studies. Case studies documenting the costs and benefits of retro-commissioning are needed for a number of government and commercial buildings. Government and commercial building owners operate in different environments and need assurance the savings can be achieved cost-effectively in buildings similar to their own.

In state buildings, the Governor's Green Building Initiative (Executive Order S-20-04) and accompanying Green Building Action Plan requires retro-commissioning of all state buildings over 50,000 square feet, with re-commissioning every five years. The California Public Utilities Commission (CPUC) is directed to fund a statewide campaign to inform building owners and operators about building commissioning and to ensure

that PGC-funded programs include building commissioning. The Energy Commission is directed to develop guidelines and standards for commissioning and to incorporate commissioning into building standards. The California Public Employees Retirement System (PERS) and the State Teachers Retirement System (STRS) are directed to consider cutting energy use in their California real estate portfolios through retro-commissioning. Case studies on retro-commissioning that result from the Green Building Initiative would serve as valuable examples for government buildings and businesses.

The program's cost of $22.6 million would be paid for by property owners. Each of the utility administrators of PGC-funded programs should pursue aggressive incentives programs for retro-commissioning. Annual energy savings of 52 gigawatt hours and 26 megawatts are estimated.

Commercial Building Benchmarking

This strategy uses commercial building benchmarking to motivate building owners to improve the energy efficiency of their building(s). As with the homeowner strategy, this plan provides energy consumption information in a form that customers, in this case commercial building owners and operators, can use to compare how their buildings perform against similar buildings. Once a building is benchmarked, further steps are needed, such as a detailed building energy audit, installation of efficiency measures, and retro-commissioning, to ensure that all energy using equipment is installed and operating properly.

The Governor's Green Building Initiative, (GBI, Executive Order, S 20-14) and the accompanying Green Building Action Plan call for benchmarking of all commercial and public buildings. It directs the Energy Commission - in consultation with other governmental agencies, public and private utilities, and the business community - to develop a plan, timetable and recommendations for accomplishing benchmarking of all buildings in the State. The CPUC is directed to play a major role in leading utility action to accomplish this and all other GBI goals. The GBI calls for benchmarking at the time-of-sale and the disclosure of benchmarking ratings to tenants, buyers and lenders. This AB 549 report to the Legislature strongly supports the Executive Order, which relies on benchmarking as an important first step toward greater energy efficiency in the commercial building market. AB 549 research found that benchmarking should have multiple levels of increasing detail so that simple benchmarking could be done and potentially more meaningful comparisons could be made by more closely examining building characteristics and uses.

To achieve significant energy savings, the proposed benchmarking strategy depends on financing or refinancing as important trigger events. Utilities are the logical delivery mechanism to periodically benchmark all commercial buildings, and to refer building

owners to auditing and retro-commissioning services, and to inform them of available incentives.

The estimated program cost of $2 million would be paid for through PGC funds. Annual energy savings of 26 gigawatt hours and 6 megawatts are estimated. The rationale for energy savings from benchmarking is that it will lead to energy audits, and customers having measures installed. Details of the fraction of customers assumed to schedule an audit through the benchmarking process and then also install efficiency measures are found in the consultant report appendices.

Low Income Multifamily Housing

Multifamily apartments and condominiums represent 31 percent of the total housing stock in California, with 83 percent of these units occupied by renters. About 56 percent of multifamily occupants earn less than $35,000 per year, making about 17 percent of the total units in the state low income multifamily. The combination of having units occupied by low income tenants and the split incentive situation, where tenants pay the bill so the building owner who must pay for improvements does not receive the reduced bill benefit, makes this group especially hard to reach. This strategy is intended to improve the energy efficiency of existing multifamily, low income housing in California by working within existing policies, procedures and agencies. While low income multifamily housing was the focus of this strategy, many of the features are applicable to multifamily housing that is not low-income.

These elements form the basis of the multifamily housing strategy:

- Use the subsidized housing tax regulatory process to accomplish energy ratings and energy efficiency upgrades.

  Developers that participate in subsidized housing programs generally receive tax credits and other financial incentives for their investments. Energy ratings should be required as a condition of participation in these programs and the cost of ratings should be covered by program funding. Energy efficiency upgrades that are found to be cost effective through these ratings should be funded by these programs.

- Fund HVAC tune-up

  Program funding should emphasize HVAC system tune-ups, including checking and repair of an air conditioner's refrigerant charge. It should also check airflow and duct sealing for small HVAC units, and retro-commissioning of larger HVAC systems. The strategy should be funded by the PGC.

- Provide technical assistance for multifamily property management

  PGC funded programs should provide information, training and technical support to multifamily housing property and asset managers about energy ratings and audits and cost-effective energy upgrades. The strategy includes developing

utility bill tracking software for property managers and training them on how to use it to help highlight problems. Technical assistance also should be provided to state housing agencies, local housing authorities and non-profit agencies, who generally do not have the expertise necessary to properly evaluate and manage energy efficiency improvement projects.

- Use property rehabilitation and time of sale as key trigger events

  Typically in housing rehabilitation projects, tenants are relocated during renovation, providing the opportunity to upgrade major building systems such as windows, insulation, common area lighting, HVAC and water heating. At this trigger point, and when properties are sold, energy ratings and retro-commissioning can be systematically completed for many units, reducing "per unit" costs.

- Use operation and maintenance as a key trigger event

  Many older properties are master metered, but would still benefit from low cost or no cost improvements, such as boiler control measures.

- Develop interagency partnerships between state housing agencies and the Energy Commission to provide technical support services to local housing authorities, non-profit organizations and project developers.

  During public comment on the draft consultant report, staff was encouraged to offer technical support about energy efficiency to state and federal agencies, much like we do now for public facilities.

- Revise utility allowances for low income housing properties

  Public agencies administering these programs should change the use of utility allowances to properly reflect the consumption characteristics of energy efficient properties. By lowering the utility allowance for these properties to reflect efficiency improvements, property owners would be permitted to charge higher rents, since tenant utility bills would be lower. Consistent and accurate methods need to be developed for estimating utility costs in standard and energy efficient buildings.

- Provide energy efficiency training to operating and maintenance personnel, property managers and asset managers

  Most property managers are unskilled in planning and implementing energy efficiency projects. They often can not develop an action plan for carrying out the results of an energy audit. Many nonprofit organizations have an asset manager who makes decisions on capital improvements and investment decisions for properties they own, but this person may have little experience with energy efficient technologies. Public goods funding should be used to provide this training. It should be developed in partnership with the Department of Housing and Community Development and housing management associations.

The program cost of $27 million would be paid through the individual funding sources identified above. Annual energy savings of 16 gigawatt hours and 26 megawatts are estimated. Savings could be significantly higher by applying features of this strategy to multifamily properties other than low income.

Residential Equipment Tune-Ups

This strategy focuses on increasing the frequency and effectiveness of Heating Ventilation and Air Conditioning (HVAC) system tune-ups and maintenance services for single family and multifamily residential customers. Old, inefficient, improperly installed or improperly serviced equipment results in below optimal performance levels and contributes to wasteful peakload energy use. This strategy asks HVAC service technicians to improve HVAC system efficiency by testing and correcting faulty performance. To succeed, this strategy will require increasing the competency of contractors; educating consumers about HVAC issues and solutions; and providing incentive funding to reduce the cost of HVAC system testing.

This strategy would insure that technicians properly check and correct airflow, refrigerant charge and duct leakage during equipment replacement or at the time a home is being sold. The Building Standards already recognize the importance of proper refrigerant charge and duct sealing when equipment is replaced. Replacements are alterations that are subject to the Standards, and contractors are required by the Standards to seal ducts when heating and air conditioning components are replaced, and to check refrigerant charge or install a thermostatic expansion valve (TXV) when split system air conditioners are replaced. This strategy would consider adding, in future standards, the checking of proper airflow, as well as refrigerant charge for package air conditioners. These Building Standards requirements only are accomplished when local building departments require building permits for these alterations and contractors and homeowners comply. PGC funded programs, working with equipment manufacturers, distributors and contractors, can accomplish savings that would not be achieved through ordinary passive reliance on enforcing and complying with the Building Standards. PGC funded programs should also encourage HVAC tune up at time-of-sale, when home ownership changes. This supplements the “time of sale home energy ratings” strategy, which provides a list of cost effective measures that the new owner may consider. The tune up strategy would check air conditioning systems at time-of-sale and correct any performance problems. The tune up strategy is attractive for multifamily applications where the cost per transaction can be even lower than in the single family market.

Approximately 65 percent of California’s 12.2 million households have central air conditioning and would therefore be candidates for this strategy. Annual energy savings of 15 gigawatt hours and 20 megawatts are estimated.

Energy Efficient Commercial Leasing

This strategy encourages the use of energy efficiency improvement clauses in commercial leasing contracts to promote greater energy efficiency. A standard set of energy efficient leasing agreements would be developed that could apply to a wide range of business types. Promotional efforts would also attempt to place these agreements into the market in a way that causes these lease provisions to become an accepted and standard practice.

The Building Owners and Managers Association (BOMA) offers a lease agreement that would be used as a model, containing provisions that encourage building owners to make investments in building upgrades and recover these costs from their tenants. Building owners would be encouraged to move away from net leases, where tenants pay the energy cost, to fixed base leases where the owner pays expenses up to a certain fixed amount, and the tenant pays any remaining costs. This provides the incentive for the owner to make efficiency upgrades, while limiting the risk if the tenants cause disproportionate energy consumption and encouraging the tenants to practice efficient energy operation.

Educating building owners, tenants and real estate agents is a significant part of this strategy. Partner networks, such as Energy Star® and LEED, would teach building owners about model lease provisions that encourage investments in energy efficiency. Real estate agents can influence tenants about property selection and lease terms and should therefore be informed of possible clauses to negotiate into lease agreements, such as periodic benchmarking and efficiency improvements. Information on the advantages of energy efficient buildings and the existence of model lease clauses should be placed into continuing education classes required by the applicable state licensing boards for real estate agents, lawyers, property managers and appraisers. Energy efficiency would represent one module of the mandatory classes.

PGC funds would cover the program cost of $700,000. Annual energy savings of 4 gigawatt hours and 1megawatt are estimated.

Demand Response

Demand response seeks to reduce peakload energy use by changing all customers to a new, default critical peak pricing rate (with an option to switch back to non-time based tariffs if they choose). It would educate customers about opportunities for automated controls. The term “demand response” refers to customer’s actions to cut energy use as a result of either higher prices or emergency signals provided by their utility, such as a warning that the electricity system itself is threatened by unusually high peak demand for power.

Consumers need to identify controls that will not lead to a reduction in service or comfort and will help them understand if they will be better off on the new rate structure. In a pilot program, the average utility bill for 70 percent of customers fell after switching to a time based rate. Rate structures have an important impact on demand response by providing time-of-use or critical peak pricing rates, giving consumers an incentive to shift electric use when electricity system costs are high. For the rate structure to be effective, consumers must be educated about it and be willing to respond accordingly.

Currently, the Energy Commission and the CPUC are jointly developing demand response rate structures. The vision is for critical peak pricing to become the default rate for residential, small commercial, and large customers, with real time pricing to become the default rate for very large customers. The shift to these rate structures will help to prevent high system costs and outages in the electricity network, but education must take place on the financial benefits before customers accept them.

Large reductions in demand can be achieved with automatically activated technologies that reduce energy consumption as pricing signals are received. Automated demand response technology would ensure that load shedding occurs during an energy crisis in real-time, and would not be dependent on manual actions. Although there are technologies to support such programs, this is a new field, and more enabling technologies need to be developed. The Energy Commission also should investigate using the Building and Appliance Standards as a way to bring these capabilities into the marketplace.

Estimates of program costs, annual energy savings and cost effectiveness for the demand response strategy were not within the scope of this project, although joint pilot projects of the two Commissions indicate that the potential for energy savings is high. While a mandatory rate structure change would cause 100 percent participation, those interviewed during the AB 549 work suggested that only 50 to 70 percent of consumers would change their electricity use; some consumers do not have such flexibility. Even so, experience in California and other states indicates that energy savings from demand response can be impressive. Despite predictions of 260 hours of rolling blackouts, California experienced only one contingency event throughout the summer of 2001. Major contributing factors were the extensive level of peak demand reduction (on the order of 10 percent) resulting in part from demand response programs.

Strategies Deserving Further Consideration

Upstream Incentives and Partnerships

Providing upstream incentives would help reduce the risk and cost of producing and deploying new energy efficient products. Incentives would be given to the manufacturer or distributor. This is likely to be more cost-effective than incentives applied at the consumer level, since the markups that occur from manufacturer or distributor to retailer

would not reduce the benefit of the incentive to the consumer. Each rebate dollar provided to the manufacturer would be equivalent to reducing the consumer price by perhaps $1.50 to $2.00, after accounting for the markup effects that would have occurred with a one dollar rebate applied to the retail price. By lowering manufacturing/distributor costs (and end user prices), new energy efficient product sales would be stimulated beyond the current pace.

For this strategy to work, information must be provided about case studies and demonstrations to help market the product and to continue research and development efforts. This requires developing partnerships between manufacturers, utilities and government.

The Energy Commission, through its Public Interest Energy Research (PIER) program, and other groups have been sponsoring development projects with manufacturers for several years. Products such as horizontal axis clothes washers, high efficiency heat pumps and furnaces, advanced lighting controls and fixtures and electronic thermostats are a few that were jump-started with research and development funds provided to manufacturers from utility, government or private research management organizations. Since manufacturers often supply a national market, we should continue efforts to attract national partnerships with manufacturers and national research and development organizations to defray costs and to increase the opportunities to aggressively market such products.

Some partnerships are currently underway in PIER program areas such as power supplies, residential and commercial heating, ventilating and air-conditioning, lighting, and controls. With infrastructure in place, the PIER program will look for opportunities to create more partnerships. Additional funding is needed to pursue these opportunities in the areas that have the greatest potential to reduce energy use and peak demand.

A final element of this strategy is technology transfer. As products are developed and demonstrated, technology transfer assistance is needed. One of the main flaws in past programs to develop energy efficient products has been a lack of aggressive, continual promotion of the merits of the technology beyond its initial market introduction. Ongoing investment that differentiates the advantages of the energy efficient product from its less efficient (and often lower cost) competitive product, could substantially increase the market penetration of the product. Technology transfer efforts should address customer concerns with new products and should extend well beyond the completion of the research, development and demonstration. Technology transfer would be designed to mesh with the manufacturer's sales efforts and would be jointly "branded" by the manufacturer and the research and development sponsors.

It was not possible to assess the potential energy savings and costs of this strategy. However, staff recommends further consideration of this strategy.

Energy Efficient Procurement

This strategy deals with purchasing procedures and standards for energy efficient product specifications conducted by government and non-profit organizations. The Green Building Initiative directs all state agencies that purchase electrical equipment to insure that this equipment is Energy Star®-rated where cost effective and that procurement goals minimize energy use; an effort is currently underway for state government to update its energy efficient procurement program. Staff recommends that these initiatives be aggressively pursued, and that these initiatives consider ways to expand the use of procurement guidelines more widely. California has established regulations that allow state purchasing contracts to be used by all governmental jurisdictions and nonprofit organizations, creating significant leverage for not only energy but tax dollar savings. The foundation for large-scale energy efficient purchases is in place; it has only to be more effectively used to increase energy savings.

The procurement strategy should be a mandatory approach to provide clear guidance to all state purchasing agents. Participation of non-profit and local governments that are eligible to buy off of state contracts would remain voluntary but would be widely encouraged.

This strategy encourages current efforts and expands them. It would establish within state government more effective purchasing procedures, and improve ways of evaluating products and applying energy efficiency credits to the purchase of technologies that reduce energy demand and save energy. A strong, central product assessment office that evaluates energy efficiency products could be established. Auditing staff would need to be qualified, skilled and knowledgeable about energy efficient products. Staff would need to communicate with others on changing products and new analyses. They would need to visit and provide presentations to agencies throughout the state, publicize success stories, design feedback for participants to quantify their savings, and monitor compliance with purchasing standards and specifications.

This strategy would need a few years to prove itself. While savings could not be reasonably estimated, if this strategy is properly designed, launched and supported, the savings could be substantial. The purchasing standards and product specifications that would come out of this strategy could be of value to any organization making similar purchases. While the strategy targets government and nonprofit entities, the resulting products could also be adopted by private sector purchasing officials. The potential “spillover” of savings from this type of program could be as much or even more than the savings captured within the target market.

However, the existence of procurement requirements does not guarantee complete compliance. For example, individuals with authority to purchase may disregard the purchasing procedures. When the energy efficient item costs more than the traditional product, some non-complying purchases are inevitable. Despite this liability, and with the difficulty of quantifying energy savings and costs, staff recommends that the

procurement strategy be pursued further. State efforts to develop more effective purchasing procedures should also be pursued with utility administrators who have identified the same goals.

Energy Efficiency Technical Training

Training of energy auditors, retro-commissioning service providers, whole-building contractors, property managers, building operators, and real estate professionals is vital. To better assess energy efficiency in the market, energy auditors and contractors must earn the trust of customers before actions are taken or energy efficiency dollars are spent. To gain trust, training must be linked to service provider certification. Staff and participants in the AB 549 project agreed that this is essential to help avoid cost prohibitive audit recommendations, improperly installed and commissioned equipment, and customer concerns with provider qualifications – all drawbacks that could prevent energy efficiency gains.

A key barrier to increasing the number of energy assessments is the shortage of people to do this work. Staff repeatedly heard that a shortage of highly skilled, trained and certified individuals (especially at the whole building level) stands in the way of expanding energy efficiency services in California. In the commercial buildings sector, the need for retro-commissioning training is critical. Residential sector training should focus on contractor training. Interviewees and expert panel members indicated that training should also be linked to strategies that would build demand for their services, so that certified individuals can readily find work.

Technical and community colleges are the logical vehicle to provide such training opportunities. Because of the higher cost of equipping classrooms with HVAC equipment and testing apparatus compared to student desks, these colleges have been hampered in providing energy training unless it is underwritten through a reliable funding source. Interviewees suggested that a statewide education and training strategy could be initiated for $20 million dollars a year, could be implemented and begin producing skilled professionals with advanced skills one year later. Financial support should be linked to performance. How the funds are spent, the quality of the training, and how well it meets the needs of the marketplace should be monitored.

California's technical and community colleges should be provided with jump-start funding, at least in the short-term, until the training programs become well established and provide clear value to participants enrolled in the coursework. The Energy Commission, an independent private sector firm, or a nonprofit organization skilled in developing training and certification processes could develop a central office to coordinate these efforts. Manufacturers and organizations such as North American Technician Excellence (NATE) should be engaged in this strategy.

It is estimated that energy consumption in the typical home or office building can be reduced by 20 to 35 percent if current, cost-effective, readily available technologies are used. However, identifying where the savings can be achieved, and what changes are needed to achieve these savings, requires skilled energy auditors and properly performed retrofits or system adjustments. Providing a way for the labor force to acquire these skills is critical to capturing savings, although it remains difficult to estimate the potential of those savings and the portion that should be directly attributed to training programs. Training is a large investment of time and dollars. While this strategy is not among the top recommended options because of the difficulty of assigning it energy savings, its linkage to other strategies is clear. Therefore, it warrants further consideration.

Energy Efficiency Risk Protection

When making energy efficiency decisions, customers tend to avoid risk and to have product reliability and performance concerns. While cost is the most common barrier cited with energy efficiency, these other barriers can significantly outweigh price considerations. Few programs, if any, address these barriers individually; to staff's knowledge, none address them collectively.

Energy professionals are reluctant to enter into the risk assessment and risk protection arena. It is considered a part of the insurance industry or the product guarantee and liability fields. As a result, the market is less efficient, and energy efficient choice decisions are sometimes abandoned for the comfort of doing things the way they have always been done.

Risk protection involves assessing the likelihood that a technology will not meet customer expectations of performance and reliability and therefore not deliver sufficient cost savings. Cost allocation tables would be developed to help determine how much of the risk cost should be carried by the protection plan and how much by the participant. A pilot program would be designed with assistance from risk protection experts. The program would need to address issues such as length of coverage, and how costs would be covered in various situations that could occur. An example would be ways to determine the cause of equipment performance malfunctions and the entity responsible for correcting the situation. Program materials would need to be developed, such as benefit descriptions and enrollment forms.

While it is not possible to quantify the energy savings or cost effectiveness of this strategy, there are logical reasons to test the concept, therefore staff recommends that it receive further consideration.

Strategies Not Recommended for Further Consideration

Branding

This strategy would develop improved branding strategies to capture additional energy savings in residential and nonresidential applications. While there is strong interest in using branding and co-branding to capture additional market share, brands such as Energy Star® may not reflect the most efficient product choices, or cover all of the technologies and services needed in California. Energy efficiency branding strategies would focus on more efficient products and services and would go beyond some of the lower performance levels currently recognized through the Energy Star® brand.

Energy Star® is a widely recognized and successful national brand. However, it can be slow to adopt new products or withdraw a product when more efficient choices are available. Thus, while Energy Star® is an indicator of higher efficiency levels, the Energy Star® program can have limitations to its value as a marketing tool for California. Other states and programs have addressed these drawbacks by co-branding approaches or adopting levels that go beyond those of Energy Star®.

In some cases, promoting the Energy Star® brand may not be the best branding approach if the goal is maximizing energy efficiency in California. The question can be: should California move beyond Energy Star® and establish its own program goals? Should California programs offer incentives or market only products that meet California requirements, or should California co-brand with Energy Star,® focusing only on these products that are the most energy efficient? The pros and cons of choosing one direction or another are discussed within the main report.

It was not possible to quantify the energy savings or cost effectiveness of this alternative branding strategy. At this time, staff believes that decisions about accepting Energy Star® branding, co-branding or setting California-only program requirements should continue to be made on a case-by-case basis.

Information, Case Studies, and Demonstrations

This strategy would establish a centralized way to provide information on energy efficiency. Materials would include fact sheets, brochures, product directories, installation and operation guidelines, training materials, presentations and technical papers. A plan for distributing information would also be prepared; it would involve the use of utilities and their energy centers, government organizations, energy efficiency and environmental advocacy groups, manufacturers and their distribution chains, as well as trade associations and their distribution chains, to provide information to building owners, specifiers, facility managers, and consumers. Training materials would include manuals, presentations and videos. Content would be tailored to participant interest groups.

Case study results and demonstration projects would also be important. Case study performance information - for installations as similar as practical to potential customers - is effective in addressing concerns. Walk-through tours of demonstration projects, with state-of-art monitoring and recording instruments, are also recommended.

Staff at the five utility-sponsored energy centers would assist with organizing and promoting pilot training for energy efficient systems and practices. Product information would be included with curricula for all-day or half-day training sessions. Opinion leaders within industry and government would be contacted to initiate a “word of mouth” awareness and encourage participation in training, to inform others of new product lines and of upcoming association, utility and government events and meetings.

It was not possible to quantify the energy savings or cost effectiveness of this centralized information strategy. The type of information that this strategy recommends is commonly developed as a part of individual programs. While centralizing part of this information may have merit, staff does not recommend pursuing this strategy as a priority at this time.

CHAPTER 1 — INTRODUCTION

While California's electricity system appears stabilized for now, Californian's still remember the electricity crisis of 2000 and 2001 which produced skyrocketing electricity costs and rotating power outages. A returning crisis situation could occur in the future unless the state takes aggressive steps on several fronts. Achieving greater energy efficiency represents one front and remains a deeply-rooted cornerstone of state energy policy. Reducing energy consumption and peak demand through greater energy efficiency is, without question, one of the least costly and most expeditious tools for improving the reliability and cost of energy in the state.

Two energy policy documents, the *2003 Integrated Energy Policy Report* and the *Energy Action Plan* also identify energy efficiency as a fundamental policy. *The 2003 Integrated Energy Policy Report* recommends increasing funding for energy efficiency programs to achieve at least an additional 1,700 megawatts of peak electricity demand reduction and energy savings of 6,000 gigawatt-hours of electricity and 100 million therms of natural gas by 2008. The *Energy Action Plan*, adopted by the California Energy Commission (Energy Commission), the California Public Utilities Commission (CPUC), and the California Power Authority, set a goal of reducing per capita electricity consumption. The recommendations within the following report will play an important supporting role in developing policies to meet the energy efficiency goals set by these agencies.

The linkage between energy efficiency and maintaining adequate electricity reserves is also well documented. In the Energy Commission's staff draft *Summer 2005 Electricity Supply and Demand Outlook*, the role of energy efficiency is a clear component, among many, in ensuring that electricity reserves remain adequate. As stated:

> "Inadequate electricity reserves will become an increasingly greater concern in future years unless additional generation is built, retirements of generating units are delayed, the transmission system improved, and *additional energy efficiency measures are implemented.*"(emphasis added)

The strategies proposed in the pages that follow represent a response to AB 549 (Longville), Chapter 905, Statutes of 2001, which calls upon the Energy Commission to investigate options to reduce wasteful peakload energy use in California's existing residential and nonresidential buildings. The legislation breaks new ground by directing attention to the energy savings potential of the existing, rather than the new, stock of buildings. The AB 549 industry sponsor, the California Building Industry Association (CBIA), rightly points to the much larger number of existing structures compared to new construction and the potential for significant further energy savings. While the value of energy efficiency improvements is widely recognized by policy makers, industry and consumers, the existing buildings market answers to nearly nonexistent state regulatory

authority regarding energy efficiency. This can lead to missed opportunities for achieving further peakload energy reductions.

Clearly a long list of efficiency options to reduce peakload energy use can be developed by the active participation of the many stakeholders involved in producing, selling, operating, maintaining and improving California buildings. Each option, or strategy, would have merit in that it would reduce energy use, some at possibly little or no cost to the parties involved. Many options have already been employed by these same stakeholders over the years and these efforts should not go unrecognized.

Utilities have administered energy audit programs, rebate programs, appliance recycling programs, and many related undertakings to curb peakload energy use. Businesses have been formed to perform diagnostic testing of problem buildings and systems and the State of California, through the Governor, Legislature and various agencies has pursued many avenues to make inroads into reducing California's total energy consumption. Equipment replacements continue to contribute to California's gradual progress toward an increasingly energy efficient economy. Despite notable achievements, much more can be done to further restrain peakload energy use through improvements to existing buildings.

Because of the tremendous number of structures within the state, and a vast diversity in building age and energy use, the potential for further savings is large and clearly evident. Building types range from single family homes to high-rise multi-family buildings and from small businesses in strip malls to skyscrapers and cavernous warehouses. More than half of existing buildings were built before the first energy efficiency standards were in place, another indicator of the large reserve of potential energy and peak demand savings.

For the purposes of this project, options capable of reducing peak energy consumption include those that increase the efficiency of equipment that uses electricity during peak periods or that shifts or shaves peak demand. Options that reduce natural gas end-use consumption are included because they can help stabilize gas supplies and reduce price spikes in both electricity and gas markets since a large and growing portion of California's electricity generation is fueled by natural gas.

Generating a long list of possible efficiency options is only a small step toward eventual real reductions in peakload energy use. Some priority must be assigned to strategies that hold the most promise or decision makers would be confronted with near limitless choices, with few indicators to discern which strategy to pursue and by what means. In determining the menu of options, several factors must be considered including:

- energy savings potential
- cost and cost effectiveness
- ability of the infrastructure to meet potential demand
- whether voluntary or mandatory approaches would work best

- productive synergies between strategies, and
- stakeholder support

The route taken in the following work for investigating possible strategies was based upon literature reviews, program manager interviews, key informant interviews, expert panel discussions, public comments and in-depth analysis of consumer opinion survey and appliance saturation survey data. Market barriers to adopting energy efficient technologies were also explored as well as research into consumer and other market participant motivations and behaviors. More detailed discussions of the approach used and the feedback received can be found in two supporting consultant reports:

- *Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings* (publication number CEC-400-2005-011-D)
- *Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings, Appendices* (publication number CEC-400-2005-011-D-AP)

Public Goods Charge funds of $300,000 were used for this portion of the AB 549 work as well as $80,000 from the Energy Commission's Energy Resources Program Account. The technical support aspect of this project was lead by Architectural Energy Corporation (AEC) under Contract Agreement No.: 400-04-001. Subcontractors assisting in this effort were TecMarket Works, Lutzenhiser Associates, RLW Analytics, Morton Blatt and the Davis Energy Group. To help guide this study, a Project Advisory Committee was formed comprised of members of the California Measurement Advisory Council (CALMAC), which includes representatives from the investor owned utilities, the CPUC and the Energy Commission. The Project Advisory Committee provided guidance to the contractor and staff and was involved in the review of products developed over the course of the contract.

With any paper study it is important to recognize that results are estimates and subject to variation for many reasons. One obvious example is that actual results depend upon how customers respond to proposed strategies. Not only is individual human behavior complex, but the strategies which follow involve many stakeholders so that this complexity is compounded. Furthermore, many assumptions must be made in deriving estimated effects, such as energy savings. It can be argued that each assumption in a series of assumptions introduces greater uncertainty in the analysis. Despite this analytical limitation, great effort has been invested in maintaining a realistic perspective when formulating these assumptions.

For example, the residential time-of-sale strategy, described later, shows an estimated 60 Gwh of electricity savings and assumes that only homes built before 1979 are targeted. Of this building stock, approximately 27 percent are assumed to be for sale and that only 10 percent of these homeowners request an energy inspection. Of those 10 percent, fewer still are assumed to be eligible to proceed with a specific measure, such as air conditioning duct testing and repair (13 percent), and still fewer elect to have leaking duct work repaired (46 percent). The detailed assumptions for each strategy and measures within a strategy can be found in Appendix F of the consultant report.

Further limitations should be noted regarding cost effectiveness conclusions and determinations of energy policy readiness. The cost effectiveness analysis considered two broad measures. The first is participant cost effectiveness which includes energy cost savings, incentives paid to the customer and the customer's out-of-pocket cost for the measure(s). Total Resource Cost (TRC) is the second indicator and includes the above costs as well as program administration and advertising costs. In addition, the net present value of the utility avoided costs over the life of the measures is addressed in determining TRC. The avoided cost calculations take into account the time dependent nature of avoided costs, meaning that summer peak savings are valued more highly than off peak savings, and also consider generation, transmission, distribution and environmental costs.

Resulting benefit/cost ratios of greater than one indicate that the strategy is cost effective. However, these results are not precise since, once again, they depend upon many assumptions and are being applied to very broad strategies. The cost effectiveness analysis is useful in indicating relative cost effectiveness with the understanding that benefit/cost ratios for one strategy could certainly be higher or lower depending upon the assumptions used. Strategies with an information component, or those heavily reliant on information to reduce market barriers, are especially difficult to assess and should be viewed with an appropriate dose of uncertainty.

One of the more subjective elements of evaluating strategies has to do with market and policy readiness. Several criteria were used to qualitatively assess the likelihood of each strategy's success, including:

- Need for, or existence of, regulatory authority
- Degree of policy maker support
- Degree of market participant support
- Ability to pay, and
- Ease of implementation, or moving from a voluntary to mandatory approach

While not dismissing the validity of the recommended strategies, it is appropriate to acknowledge the complexity of the AB 549 project and the need to make best guesses regarding these frequently unquantifiable, but influential factors.

The remaining report chapters are as follows:

Chapter 2. Strategies Investigated. A discussion of all strategies considered to address the directives of AB 549.

Chapter 3. Strategy Ranking and Action Plan. The set of strategies given greatest likelihood of accomplishing significant, cost effective, peakload reductions and the recommended steps for reaching that end.

CHAPTER 2 — STRATEGIES INVESTIGATED

The Energy Commission considered many strategies for reducing peakload energy use in existing buildings. The sixteen presented in this chapter represent the full range of responses reviewed by the Energy Commission in conducting a comprehensive investigation of available options. This set of strategies grew out of a series of activities undertaken during the course of the work, including literature reviews, program manager and key participant interviews, expert panel discussions, analysis of consumer opinion survey and appliance saturation survey data, and public comment. Strategies were considered based on their ability to address important trigger events, to close gaps in existing programs, to reduce known barriers, to build supporting infrastructure, and to achieve significant energy savings cost effectively. The options should be viewed as a set of mutually supportive activities, rather than isolated, independent actions. From this long list fewer strategies emerge in Chapter 3 as the most promising based on many criteria that were applied to each. Chapter 3 also describes how recommended strategies were ranked and what action steps would be needed to place them into the existing buildings market.

In developing the strategies, a review of existing programs was first necessary. The energy efficiency program portfolio for the 2004-2005 program cycle consists of close to 100 distinct programs offered by a combination of the state's four IOUs, partnerships between the IOUs and local governments, and non-utility program implementers. Most programs offer some education, training or information component. Audits, rebates, direct installation of measures, and design assistance are traditional program strategies commonly used in the current portfolio of programs. Commissioning services and/or operations and maintenance services are offered in 10 percent of the programs. Innovative financing and upstream market incentives are the least used strategies in the portfolio. While the majority of programs target retrofits, those targeted at repair, building sale and building finance/refinance market events are rare.

Whether a strategy works to fill a gap or enhance an existing program, attention was also given to identifying known and potential barriers to using the strategy and the actions needed to overcome these barriers. Market barriers take many forms and include product, participant, market, and purchase or provider barriers. Within each category are multiple sub-categories that illustrate the complexity of issues to be confronted by any proposed strategy. For example, product barrier sub-categories include first cost, life-cycle cost, payback period, hidden or unexpected costs, uncertain reliability and performance, design limitations, and product options offered.

Regulatory barriers are also evident and often occur through unintentional conflicting regulatory interests. One example brought to the staff's attention dealt with replacing less efficient refrigerators with new Energy Star® models in multifamily housing. After replacement it was learned that the door handle locations did not comply with the

Americans with Disabilities Act requirements. Another example involved the installation of strip curtains as an energy efficiency measure for refrigeration in small stores. Health department inspections then indicated that practices at some stores created cross contamination of food on the curtains so they were removed. These examples demonstrate the need to temper energy savings expectations because of the complexity and reality of barriers confronting a technology or idea. Further discussion of barrier types and sub-categories is provided in the consultant report *Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings*.

Staff also considered what stakeholders would be involved and how they interact since stakeholder interactions directly influence decisions affecting the energy efficiency of buildings. The homeowner chooses a particular contractor because of trust, cost, availability, quality or some combination of these or other criteria. It should be noted that interactions that influence decisions may not be solely between individuals, but often include other elements, such as technologies, building codes, or contractor certifications. Being mindful of stakeholder interactions can be useful in developing policy by recognizing interaction complexity, leverage points, and the potential for interactions to cause unexpected results.

Finally, market conditions, strategy costs and energy savings are also key elements to consider in measuring the value of a proposed strategy. While objective and quantitative analytical methods are preferred, many subjective judgments had to be relied upon in accounting for these elements. In some cases it was simply not appropriate or possible to estimate energy savings and strategy cost. Despite the difficulties, these strategies are still described here since they provide a more complete picture of options and may be important to the success of others.

The strategies that follow are divided into residential and nonresidential categories. In some instances a strategy applies to both categories and those are presented separately at the end of the chapter. Table 2-1 displays the complete portfolio.

Table 2-1 Strategy Portfolio

Strategy Category	Strategy Name	Primary Role in Portfolio
Residential		
	Information to All Homeowners	Serves as an entry point or "information portal," providing homeowners and property managers with information, energy audits and program referrals
	Disclosure of Time-of-Sale Home Energy Ratings	Provides key information at the time of sale trigger event, giving homebuyers timely information needed to make voluntary efficiency upgrade and financing decisions
	Equipment Tune-up	Addresses a key program gap and energy efficiency opportunity
	Whole Building Diagnostic Testing	Addresses a key program gap and energy efficiency opportunity
	Low Income Multifamily Housing	Addresses a key program gap and energy efficiency opportunity, while also addressing issues of equity and underserved populations
Commercial	Benchmarking	Serves as an entry point or "information portal," providing commercial building decision makers with information on building performance, energy audits and program referrals
	Retro-commissioning	Addresses a key program gap and energy efficiency opportunity
	Commercial Leasing	Addresses a key trigger event and market barrier
Residential and Nonresidential		
Upstream	Incentives and Partnerships	Addresses a key program gap and energy efficiency opportunity
	Energy Efficiency Procurement	Designed to build market demand and efficiency industry capacity
	Branding	Designed to lend support to many existing programs and improve the energy savings attained by those programs
Information and Training	Information, Case Studies and Demonstrations	Designed to address key barriers to energy efficiency technology adoption
	Energy Efficiency Technical Training	Designed to address key barriers and build efficiency industry capacity
Overarching Initiatives	Demand Response	Designed to address key program participation barriers
	Energy Efficiency Risk Protection	Designed to address key barriers to energy efficiency technology adoption
	Interagency Program Coordination	Designed to support existing programs and improve their overall effectiveness in the market

RESIDENTIAL

Information to All Homeowners

Throughout the AB 549 effort, the staff heard about the importance of reliable energy efficiency information for California households. The Information to All Homeowners strategy focuses on providing energy efficient technology information to homeowners and property managers through online energy audits and referrals to existing energy efficiency programs. This strategy is intended to function as a centralized information portal or gateway, directing interested parties to energy efficiency program services. It would function continuously and therefore does not depend upon on any specific trigger event, meaning that it would not come into play only when equipment needs replacement, when property is sold, or when some other event creates a natural opportunity for a customer to consider corrective or improvement measures. Elements of this strategy include:

- Targeting buildings with the greatest potential for energy savings, requiring utilities to compile energy use data to identify those customers meeting any targeting criteria
- Providing feedback on customer energy use through utility websites
- Providing online home energy audit information in a multi-level format that allows the customer to more deeply explore their energy use patterns and options for saving energy. Additional levels of energy audits (e.g., over-the-phone, in-person) would be provided to targeted and/or interested customers.
- Connecting customers with opportunities for financing energy efficiency upgrades either through existing programs or through a separate program
- Providing customers with energy efficiency program marketing materials through bill stuffers, online customer service applications and Flex-Your-Power media campaigns

As originally envisioned, this strategy would be undertaken primarily through utility websites where customers would receive feedback on their energy consumption compared to like customers. The feedback would be formatted to motivate customers to delve deeper into understanding their energy use patterns and options for saving energy. While California utilities currently offer online audits, this strategy would represent an enhancement to those services.

Staff received constructive comments on this strategy at its public workshop on the content of a draft consultant report prepared in support of the AB 549 work. Participants noted the limitations of current online audits and customer access to online services and the need for much larger (and costly) media campaigns associated with this strategy. Despite these limitations, estimated energy savings of 67 gigawatt hours from this strategy ranked it second highest out of the ten strategies where savings were

quantified. While the overall cost effectiveness of this information strategy is very difficult to determine with precision, the participant cost benefit ratio exceeded one. In terms of total resource cost, the strategy's cost effectiveness was less than one. This is because far reaching media information programs are costly when expenses are fully counted.

Staff recommends the following:

- Each utility should establish a centrally administered information gateway for residential energy efficiency information and referrals to efficiency programs and services offered by, utilities, non-utility program implementers and the Energy Commission. In providing information, customers with the greatest potential for energy savings and/or the highest energy cost burden for energy audits and program services should be targeted regardless of the year of home construction. Buildings should include single family and multifamily units targeting residents, property owners and/or property managers as appropriate. An advisory group should be formed in 2006 of utilities, third party implementers and industry experts to assist with shaping and coordinating the effort.

- The strategy should offer feedback on customer energy use through utility websites. Customers without access to the internet, or those that do not use online billing, should be provided with written communications on tracking their energy use in comparison to similar customers.

- The home energy audit information should offer a multilevel format that allows the customer to explore their energy use patterns and options for saving energy to as much depth as necessary to motivate action. Utilities should collect building description information and deliver audit results online, over the phone, through the mail or in person as necessary to reach targeted customers. Local governments and community-based organizations should be included in the strategy to help reach targeted customers.

- The audit report should include marketing materials and referrals that are tailored to the customer's needs and provide linkages to existing programs and services that are available for the customer to take action on the audit findings.

- Easy access to financing assistance should be offered, through either existing programs or a separate initiative, to motivate customers to make efficiency upgrades.

- The Flex-Your-Power media campaign should be used to advertise and promote the Information to All Homeowners strategy.

- The CPUC and utilities should investigate utility resources necessary to upgrade utility billing information systems to offer customers more interactive energy efficiency information.

- The CPUC should consider policy revisions to encourage utilities to determine and claim credit for energy savings that can be linked to information programs.

- Confidentiality policies on customer billing data should be revisited to allow non-utility implementers access to data used for the purpose of targeting high energy use customers.

Disclosure of Residential Time-of-Sale Home Energy Ratings

The extent to which single-family and multi-family homes that are offered for sale have energy efficient features and the potential to cost effectively reduce energy use in the home are material facts that should be disclosed to home purchasers, lenders and appraisers. The Time-of-Sale strategy provides home energy ratings to ensure that realtors are able to disclose material facts about the condition of the energy using features of the home and the potential to upgrade these features to avoid excessive energy bills. The process would be phased-in over time, initially applying to homes built prior to 1982. The home energy rating provides a comparable rating to other homes, an assessment of cost effective measures to improve the energy efficiency of the home, information about financing options to make these improvements, and information about utility and non-utility incentives available to the homeowner.

Over 600,000 homes are sold annually. This population of homes is triple the number of new homes that are built each year which are subject to the California Building Energy Efficiency Standards. Critically important energy and peak demand savings can be accomplished at reasonable costs for these homes. Without improvement, these homes represent a drain on the state's energy systems, which are increasingly threatened by demand outstripping supply. The Time-of-Sale strategy is an important opportunity because the cost of improvements can be incorporated into the new mortgage on the home. The resulting ready capital pays for the improvements with modest increases in monthly mortgage payments that are substantially lower than the resulting monthly energy bill reductions. Home energy ratings also enable appraisers to obtain consistent information that can be used to recognize and increase property values for homes that have energy efficiency improvements. At the time of sale both seller and buyer have reason to be motivated to consider energy efficiency improvements.

Home energy ratings can help realtors rectify current situations where realtors must face disclosing material facts about the energy condition of the home, but lack systematic information to do so. Providing this information and facilitating the process represents a new area where realtors can provide value-added services and differentiate themselves in the marketplace. Currently, energy use information is not typically provided to the buyer. In cases where a utility bill is offered, it may not necessarily reflect the efficiency level of the home since consumption varies with occupant behavior. To assess building efficiency, an independent (HERS) evaluation is

essential. Coupling a rating with information on available incentives and energy efficiency improvement mortgage products would encourage buyers to take action to accomplish cost effective efficiency upgrades.

Through training on energy efficiency and home energy ratings, realtors can offer greater service to their customers, differentiate themselves, and become an important influence in making this strategy a success. Since the market is not currently creating demand for the number of raters needed to serve this population of homes, training of enough qualified rates to meet the new demand will be critical. With certainty of demand, business opportunities for raters will be created since many sellers would need to employ rating services. Requiring energy ratings for a portion of the older homes sold each year would produce business certainty and opportunity, while not overtaxing the rating industry.

This strategy would introduce the disclosure of home energy ratings to provide energy-efficiency related information to homebuyers with the opportunity to make efficiency improvements of interest to the buyer. Realtors would make use of HERS ratings information including the rating, financing options and program resources for improving the property. The buyer would not be required to complete any of the recommended actions within the HERS report prior to purchasing the property, but would be informed of cost effective measures that could be undertaken later. Elements of this strategy include:

- HERS rating required for homes built prior to the 1982 Building Energy Efficiency Standards
- A continuing education requirement for realtors and other professionals
- Expansion of the number of raters to meet demand
- Referrals to Energy Improvement Mortgage (EIM) services

The Time-of-Sale strategy would include a continuing education requirement for realtors and other related professions to provide buyers with enhanced customer service by providing clients with more information on which to base their purchase decision. The cost of the HERS rating could be folded into the EIM. The rating industry would also need to ramp up to meet the additional demand for the services generated from this strategy. The California Home Energy Efficiency Rating System (CHEERS) indicated that 500 HERS inspectors would be qualified by year end. GeoPraxis, an auditing firm, has also trained 340 inspectors in the use of Energy CheckUp, a computer-based auditing program. In addition, there are a large number of home inspectors, appraisers and heating and air conditioning contractors that could step forward and receive additional training if the demand for HERS ratings becomes a certainty.

Another important element of this strategy is providing the buyer with information on EIMs. This financial assistance is receiving little attention, largely because buyers are not aware of this loan instrument. Adding the cost of energy efficiency upgrades to the mortgage has several advantages. The term and interest rate of mortgage financing is usually much more favorable that consumer financing. The utility cost savings also

generally exceed the additional monthly payment for cost-effective efficiency upgrades, providing immediate positive cash flow, thus improving the overall affordability of the home.

Staff heard several concerns from participants at its public meeting earlier this year. The Time-of-Sale strategy as originally proposed would have required a HERS rating for all homes being sold. There were numerous concerns regarding increasing the cost of escrow, delaying the escrow process, the cost effectiveness of the strategy, the validity of applying the requirement to all homes and the ability of the rating industry to expeditiously offer a rating service. However, comments were also offered indicating the buyer's need for an independent evaluation of the energy efficiency of the home since utility bills, which are often not available, can represent a significant monthly obligation to the buyer. Furthermore, even when utility bills are available, they may not be indicative of the efficiency of the property since energy use can vary widely based on occupant behavior. These limitations indicate the high value of an independent party conducting an energy evaluation at the property.

The estimated energy savings from this strategy of 60 gigawatt hours means it is third highest out of the ten strategies where savings were quantified and second highest among the eight where both savings and costs were quantified. This strategy was determined to be cost effective based on either participant or total resource cost/benefit ratios.

The Time-of-Sale option received the most attention from workshop participants. The appeal of launching such a strategy for existing homes can be found in the magnitude of home sales each year in California and the age of homes represented. Despite California's sharp increases in home prices, over 600,000 homes are sold annually compared to 200,000 new homes built each year. Furthermore, more than half of the homes in the state were built prior to any building energy efficiency standards, meaning that many buyers may find that their new purchase comes with an unusually larger utility bill.

Homebuyers currently have very little information available to them to judge the energy efficiency of a prospective property. Prior utility bills, when available, can be used to document the energy costs of the home to the existing homeowner. These data, though very useful, are dependent on the lifestyle of the existing occupants. Thus, they are an indirect measure of the efficiency of the building. Utility bills do not indicate specific deficiencies in the home, such as lack of insulation, low-quality windows, old air conditioners and so on, and do not give the homebuyer information on steps to take to improve the efficiency and the cost effectiveness of the improvements.

Home energy rating systems were developed to provide this information. A physical inspection of the energy-related attributes of the home such as insulation levels, window type, age and condition of the HVAC systems and appliances are combined with computer modeling of the energy use of the home to generate a uniform rating score that allows homebuyers to compare the relative energy efficiency of properties under

consideration. The computer modeling also identifies potential energy efficiency upgrade opportunities and calculates the cost effectiveness of these upgrades.

The HERS rating automatically generates the forms necessary to apply for EIMs offered through HUD and FHA. HERS ratings, though currently available, are not widely used. Ratings are generally requested by the purchaser, after the purchase decision has been made and the home is under contract since it is costly and impractical for individual purchasers to request ratings on each home under consideration for purchase. Home energy ratings instituted by the seller prior to listing the home for sale and disclosed to potential homebuyers would provide the needed information in a timely manner.

The GeoPraxis-type rating offers an approach that provides value to the consumer until a HERS rating for existing homes is in place. The longer range goal is to make energy ratings available to homebuyers, appraisers and lenders in a timely manner and require disclosure of energy-related information as a material fact in the transaction. As a requirement, it would apply to single family and multifamily residential properties.

As revised, the strategy would be phased in over time, starting with realtor disclosure of a HERS rating to homes built before the 1982 Building Energy Efficiency Standards. The Energy Commission would need to complete its HERS proceeding prior to implementing this strategy. As a result, the earliest that this option could be implemented would be January 2008.

Staff recommends the following:

- The Energy Commission should officially conclude that the condition of energy using features, and the potential to cost effectively reduce energy use in homes, are material facts that must be disclosed at time-of-sale. This disclosure should begin through homes built prior to the 1982 Building Energy Efficiency Standards receiving a HERS rating. The rating should be easy to understand and include a description of cost effective upgrades available to the buyer. These potential upgrades should be described in sufficient detail to allow a prospective homebuyer to apply for an Energy Improvement Mortgage.

- The Energy Commission and the California Association of Realtors should work together to develop coursework for training realtors and other industry professionals on topics related to disclosure of energy efficiency and home energy rating information. This training should be used as a means of enhancing realtor customer service.

- The Department of Real Estate should make disclosure of energy efficiency and home energy rating information part of the mandatory realtor coursework to obtain or renew realtor licenses.

- The Energy Commission should complete its' proceeding to adopt regulations to establish a Home Energy Rating System to track, certify and oversee HERS raters.

Residential Equipment Tune-up

This strategy focuses on increasing the frequency and effectiveness of Heating Ventilation and Air Conditioning (HVAC) system tune-ups and maintenance services for single family and multifamily residential customers. HVAC technicians would be required to improve HVAC system efficiency by testing and correcting airflow requirements, refrigerant charge, and duct leakage during equipment replacement and at the time a home is being sold. The Building Energy Efficiency Standards already recognize the importance of proper refrigerant charge and duct sealing when equipment is replaced. Replacements are alterations that are subject to the Standards, and contractors are required by the Standards to seal ducts when heating and air conditioning components are replaced, and to check refrigerant charge or install a thermostatic expansion valve (TXV) when split system air conditioners are replaced. This strategy would consider adding, in future Standards, the checking of proper airflow, as well as refrigerant charge, for package air conditioners. In addition, mechanisms should be considered to encourage these measures at time-of-sale when home ownership changes. This strategy supplements the Disclosure at Time-of-Sale Home Energy Ratings strategy. While the home energy ratings strategy results in a list of cost effective measures that the new owner may consider, the tune up strategy would aim to have air conditioning systems checked at time-of-sale and performance problems corrected. Further information efforts should also be pursued to encourage testing and correcting performance problems when systems undergo maintenance.

The strategy would also require increasing the training and certification level of HVAC contractors. The number of certified contractors would need to increase. Tune-ups in multifamily applications are particularly appealing since the cost per transaction is lower than the more diffuse single family market.

Once installed, HVAC systems are typically ignored until they fail. Homeowners do not have experience in determining if a system is operating properly and lack confidence in the industry to remedy problems. The HVAC industry largely relies on rules of thumb when replacing or servicing these systems and because of strong seasonal demand is often pressed for time when servicing a unit which can lead to later HVAC performance problems.

It is difficult for homeowners to gauge how well their HVAC system is working. The perception is if cool air is supplied from the registers and comfort is generally being maintained, the system must be operating properly. In fact, cooler air from registers could be a symptom of reduced system airflow, a situation that reduces cooling system capacity and efficiency.

There are several other barriers associated with keeping HVAC equipment in good running condition. These include a lack of occupant's knowledge of expected equipment performance, a lack of confidence in the service industry to effectively identify and remedy equipment problems, a shortage of qualified labor within the HVAC service industry, the nature of seasonal demand for service which places intense pressure on technicians to deal quickly with the service need, the cost to the customer of repair or replacement of equipment and additional diagnostic tests, and a highly cost competitive HVAC market which makes the higher cost for these services difficult to sell profitably. Related to the seasonal demand issue is the observation that residential HVAC systems are typically ignored until there is an outright failure and those failures often occur during hot summer use.

The residential tune-up strategy seeks to improve the performance of air conditioners by increasing the training and certification level of HVAC contractors, educating customers about air conditioner issues and solutions, and offering financing or other options to minimize the upfront cost of testing and help transform this market. During equipment replacement, the technician would be required to check and correct airflow, refrigerant charge and duct leakage. This strategy is particularly attractive for multifamily applications where the cost per transaction can be much lower than in the more diffuse single family market. Staff received no objections to this strategy during its public meeting.

Approximately 65 percent of California's 12.2 million households have central air conditioning and would therefore be candidates for this strategy. The estimated energy savings of 15 gigawatt hours means it is eighth out of the ten where savings were quantified and seventh among the eight where both savings and costs were quantified. This strategy was determined to be cost effective with favorable participant and the total resource cost/benefit ratios.

Staff recommends the following:

- Training, trade organizations and the Energy Commission should develop technical training for certification of HVAC technicians.

- Funding should be earmarked for community and vocational schools with HVAC technology programs or starting HVAC programs so that training opportunities are increased to meet the need for additional qualified technicians.

- The Flex Your Power campaign should advertise and promote HVAC performance information to educate consumers and promote industry certifications.

Residential Whole Building Diagnostic Testing

The whole building diagnostic testing strategy involves evaluating house performance as an integrated system rather than as a number of unrelated parts. Climate, building materials (and the way they are assembled), occupant interaction, and mechanical equipment design and installation all affect the “house as a system” performance. This strategy allows the practitioner to identify flaws in construction or operation, use the diagnostic tools to guide repairs correcting the flaws, and verify improved performance, all in a systematic process.

A detailed diagnostic evaluation allows the practitioner to understand building performance issues and implement measures that improve building comfort, health and safety, and energy efficiency. With this approach to remodeling, synergistic benefits are likely to be realized. For example, when coupled with an air conditioning retrofit, other energy efficiency improvements may contribute to reduced equipment size of the replacement, saving the homeowner additional money. The whole building diagnostic approach represents a more comprehensive way of addressing household energy issues and more thorough testing and remediation than the residential air conditioning tune-up strategy.

The energy implications of whole building diagnostic testing services are important, but are generally secondary to issues of comfort, health and safety. Significant non-energy benefits provide leverage in implementing energy efficiency, since homeowners highly value comfort, health and safety enhancements.

For many of California’s 5.6 million older homes built prior to 1982, whole building diagnostic testing offers the potential for significant energy and demand savings in addition to non-energy benefits. Due to the comprehensive nature of the whole building approach, it is a more costly approach than efforts that focus on a single energy efficiency measure. The higher cost of the whole building approach may not be cost effective strictly through reduced energy bills except for high energy users. However, homeowners needing whole-building testing often find it very valuable and worth the cost due to the non-energy benefits that are realized. Non-energy benefits should be valued in cost effectiveness calculations and efforts to engage the insurance industry in exploring the risk reduction benefits of whole building diagnostic testing services would be pursued.

The whole building strategy could potentially be tailored to target:

- sub-regions where peak demand is straining the local transmission and distribution system infrastructure
- situations where a standard home energy rating has identified problems that need to be addressed through a more rigorous approach
- homes that have been shown to have higher than normal energy consumption that suggests an energy related problem may exist

Barriers to whole building diagnostic testing include a lack of qualified contractors to perform the work, lack of contractor motivation to differentiate themselves from competitors since more conventional work is abundant, a lack of valuing the non-energy benefits such as comfort and indoor air quality, and the extra expense associated with diagnostic testing and whole building retrofits. Two other barriers brought forth at the public meeting related to trades people who have small businesses. Experience in the San Francisco region indicates that many of these businesses are reluctant to expand their business in an area when they do not know if it will be profitable. Secondly, many contractors are "tool belt" oriented, who are reluctant to have their business become more sophisticated.

Regarding qualified contractors, the California Building Performance Contractors Association currently conducts whole building system training which involves four days of classroom education and two days of field work. About 100 contractors have been trained to use the whole building approach so far, but many more would be needed to implement this strategy once consumers are educated on its benefits and start requesting the service.

Staff received supportive comments from the public on this strategy. The estimated energy savings of 58 gigawatt hours means it is fourth out of the ten where savings were quantified and third among the eight where both savings and costs were quantified. This strategy was determined to be cost effective for participants, but not clearly cost effective from a total resource cost perspective.

Staff recommends the following:

- The Energy Commission and the California Building Performance Contractors Association should work together to evaluate the training approach.
- The Energy Commission should permit qualified contractors to self-verify HVAC performance based on documented testing protocols.
- The CPUC should investigate methods of valuing non-energy benefits in cost effectiveness calculations.
- The Energy Commission should engage the insurance industry in exploring the risk reduction benefits of whole building diagnostic testing services.
- The Flex Your Power campaign should advertise and promote the use of whole building diagnostic testing and qualified contractors.

The Energy Commission should focus the whole building strategy to target sub-regions where peak demand is straining the local transmission and distribution system infrastructure, in situations where a standard home assessment has identified problems

that need to be addressed through a more rigorous approach, and for homes that have been shown to have higher than normal energy consumption.

Low Income Multifamily Housing

This strategy is intended to improve the energy efficiency of existing multifamily low income housing in California. While low income multifamily housing was the focus of the energy savings and cost estimates for this strategy, many of the features are applicable to the balance of multifamily housing. The strategy attempts to build upon existing policies, procedures and agencies to the maximum extent possible.

Typically, a multifamily housing developer applies to the California Department of Housing and Community Development (HCD), the California Tax Credit Allocation Committee (CTCAC), the California Housing and Finance Agency (Cal HFA), a local funding source, a private bank, and possibly other sources for project financing. Resources for affordable housing developers include the tax-exempt bonds of which Cal HFA is one of the main providers, the CTCAC, and the multifamily housing program that is administered by HCD. Nearly every type of affordable housing goes through one if not multiple agencies. In most cases developers use both the tax-exempt bonds from the California Debt Limit Allocation Committee (CDLAC) and tax credit financing to preserve the project as affordable. In affordable housing projects, tax credits are involved in nearly 80 percent of the projects.

The following elements are envisioned for a coordinated strategy for multifamily housing:

- Offer technical assistance

  Provide information, training and technical support services to multifamily housing property and asset managers, including energy audits and technical assistance to implement cost-effective upgrade projects. State housing agencies, local housing authorities and non-profit agencies generally do not have the expertise necessary to properly evaluate and manage energy efficiency improvement projects. Develop utility bill tracking software to the property managers and train them on how to use it to help highlight problems.

- Encourage HVAC tune-up opportunities

  Provide new funding for HVAC system tune-ups, retro-commissioning and operations and maintenance activities targeted at multifamily housing projects. Low income housing authorities generally lack the funds for HVAC tune-ups and retro-commissioning projects.

- Use the subsidized housing tax regulatory process as a lever

  Developers that participate in subsidized housing programs generally receive tax credits and other financial incentives for their investments in low-income housing. Energy ratings and energy efficiency upgrades should be required

as a condition of participation in these programs. California should not be subsidizing lower efficiency construction practices when better practices are cost-effectively available that help lower tenant costs.

- Use property rehabilitation as a key trigger event

  Housing rehabilitation projects provide an important opportunity for improving energy efficiency. The projects are generally invasive to the point where tenants are relocated during renovation, providing the opportunity to upgrade major building systems such as windows, insulation, common area lighting, HVAC and water heating. At this trigger point, diagnostics and measure verification can be completed, reducing "per unit" costs. Again, California should not subsidize rehabilitations that are not at least Energy Star® equivalent.

- Use operation and maintenance as a key trigger event

  Staff received several requests to include O &M as an important trigger event since rehabilitation projects would limit the strategy to a fraction of the housing that could be reached. Many older properties for example are completely master metered, but would still benefit from low cost or no cost improvements, such as boiler control measures.

- Develop interagency partnerships between state housing agencies and the Energy Commission to provide technical support services to local housing authorities, non-profit organizations and project developers.

  During public comment on the draft consultant report staff was encouraged to offer technical support services regarding energy efficiency to Cal HFA, HUD, CTAC and SDLAC similar to the current technical assistance program for public facilities. This would require additional, currently unbudgeted, resources.

- Implement energy ratings

  Develop incentive programs that provide funding for energy ratings and whole-building energy audits. An energy efficient pricing scheme for multiunit developments would be created to capture savings. Services could include filling out the program participation forms for a developer, arranging for a rating, arranging for an energy consultant as necessary, and advising the developer on equipment choices. Incentive payments should be fast and focus on cost-effective measures and whole-building performance. Use existing state funding sources or public goods charge funding to cover the cost of the rating and audits. Cal HFA has a predevelopment loan program, which covers both preconstruction and/or preacquisition expenditures. Energy ratings and audits would be an eligible cost under this program; or audit costs would be a reimbursable item for successful projects. When a loan is closed with Cal HFA the costs would be folded into the financing package without requiring a separate application for predevelopment. Require energy ratings as a condition for receiving the energy efficiency funding.

- Revise utility allowances for low income housing tax credit properties

  The impact of additional costs for energy efficiency can be mitigated under the tax credit program by encouraging the use of utility allowances that properly reflect the consumption characteristics of energy efficient properties. By lowering the utility allowance for these properties to reflect efficiency improvements, property owners would be permitted to charge higher rents since tenant utility bills would be lower. Property owners that invest in energy efficiency upgrades are currently penalized in the sense that utility allowances for more efficient properties are the same as for conventional properties so that owners are not able to charge these higher rents. Efforts to establish energy efficiency utility allowances would be encouraged by state agencies and would be undertaken as part of a low income multifamily strategy. Consistent and accurate methodologies would need to be developed for estimating utility costs in standard and energy efficient buildings.

- Offer energy efficiency training to operating and maintenance personnel, property managers and asset managers

  Property manager competencies do not typically include expertise in planning and implementing energy efficiency projects. They often do not have the resources to develop an action plan for carrying out the results of an energy audit. High turnover rates among operations and maintenance staff mean that training in energy efficiency must be consistent and continual. Many nonprofit organizations have an asset manager who makes decisions on capital improvements and investment decisions for properties they own, but this person may have little experience with energy efficient technologies. Training would be developed in partnership with HCD and housing management associations

Staff was also encouraged to offer low interest loans to low income housing efficiency projects, similar to those now offered to public entities. The difficulty in pursuing this option is that the Energy Commission is not equipped to deal with defaults and other possible problems associated with such a program.

Multifamily apartments and condominiums represent 31 percent of the total housing stock in California, with 83 percent of these units occupied by renters. About 56 percent of multifamily occupants earn less than $35,000 per year, making about 17 percent of the total units in the state low income multifamily. The combination of having units occupied by low income tenants and the split incentive situation where tenants pay the bill so the building owner who must pay for improvements does not receive the reduced bill benefit, makes this group especially hard to reach.

The estimated energy savings of 16 gigawatt hours for this multifamily strategy ranked seventh out of the ten that were quantified and sixth among the eight where both savings and costs were quantified. This strategy was determined to be cost effective with favorable participant and the total resource cost/benefit ratios. Savings could be

significantly higher by applying features of this strategy to multifamily properties other than low income.

Staff recommends the following:

- Information, training and technical support services should be offered to multifamily housing property and asset managers, including energy audits and technical assistance to implement cost-effective upgrade projects. State housing agencies, local housing authorities and non-profit agencies generally do not have the expertise necessary to evaluate energy efficiency improvement projects. Utility bill tracking software should be introduced for use by property managers and train them on how to use it to help highlight energy problems. Supplemental resources would be needed to undertake these technical assistance actions.

- The Energy Commission and housing authorities should work together to highlight property rehabilitation, maintenance and time-of-sale as key trigger events for efficiency upgrades. Rehabilitation projects are generally invasive to the point where tenants are relocated during renovation, providing the opportunity to upgrade major building systems such as windows, insulation, common area lighting, HVAC and water heating. At this trigger point or at time-of-sale, diagnostics and measure verification can be completed, reducing "per unit" costs. California should not subsidize rehabilitations that are not at least Energy Star® equivalent.

- The Energy Commission should explore possible funding sources for HVAC system tune-ups, retro-commissioning and operations and maintenance programs targeted at multifamily properties. Low income housing authorities generally lack the funds for HVAC tune-ups or retro-commissioning projects.

- The Legislature should require energy ratings and energy efficiency upgrades for properties that participate in subsidized housing tax credit programs and identify possible funding sources, such as the public goods charge, to offer incentives to lower the cost of ratings and whole building energy audits. Services should be offered to help developers fill out participation forms, arrange for a rating and determine equipment choices. Energy ratings and audits should be an eligible cost or a reimbursable item for successful projects.

- Interagency partnerships should be developed to provide technical support services to local housing authorities, nonprofit organizations and project developers.

NONRESIDENTIAL

Commercial Building Benchmarking

This strategy involves the use of commercial building energy consumption benchmarking as a means to motivate decision makers, usually building owners, to implement measures that will improve the energy efficiency of a building. Benchmarking involves placing comparative energy consumption information into the market in a form that building owners and operators can use to easily see how their buildings perform relative to similar buildings in similar weather and use conditions. Benchmarking is an initial step in a comprehensive efficiency upgrade program. It can be argued that benchmarking alone may produce little or no energy savings since it in its simplest form is simply information provided to building owners. Further steps are needed, including an audit of building HVAC systems and controls and retrofitting of inefficient systems with more efficient technology. Ideally, retro-commissioning would then also be performed to assure that upgrades have been made successfully.

The Governor's Executive Order S 20-14 and the Action Plan of the Green Building Initiative (GBI) endorses benchmarking of all commercial and public buildings, calling for a plan, timetable and recommendations from the Energy Commission to accomplish such a plan. The direction provided in the Action Plan includes benchmarking at the time-of-sale and the disclosure of benchmarking ratings to tenants, buyers and lenders.

Existing commercial building benchmarking systems include the EPA Energy Star® benchmarking system and the Lawrence Berkeley National Laboratory (LBNL) Cal Arch California Building Energy Reference Tool. Both of these systems use a web interface and compare the energy consumption data of a particular building to a database of consumption data for a large number of other existing similar buildings. The EPA tool uses the federal Commercial Building Energy Consumption Survey (CBECS) data, while the current CalArch tool uses data from the Commercial Building End Use Survey (CEUS) that is specific to California buildings. The CEUS data is updated periodically—a current survey is now being conducted with building data being available for use by CalArch in late 2005. Development of the CalArch tool was funded by the Energy Commission's PIER program.

Benchmarking may compare energy consumption per square foot of floor space for comparable classes of buildings or Standard Industrial Code (SIC) designations. To calculate a "first level" benchmark requires a very limited set of information that should be readily available without requiring energy audits of the building. This first level benchmark is useful for identifying the worst performing buildings. However, many variables determine the relative energy performance of buildings. By considering more detailed information about a building and comparison information for buildings in a benchmarking database, more insightful comparisons can be made. Obtaining this more detailed information requires onsite investigation, which is time consuming and difficult to accomplish for all buildings. To address this issue, the benchmarking tool should be

designed to have multiple levels of increasing detail so that both the simplest benchmarking rating and potentially more meaningful comparisons could be done by drilling down into building details or identifying specific end uses.

Benchmarking buildings in terms of total energy consumption combines the impact of how the building(s) is (are) operated and what energy efficiency features are present. It is difficult to separate equipment/facility efficiency from the operational issues without additional descriptive information about the building. To address these possible differences a comparison of the energy consumption of the building to a minimally Title 24 compliant version of the same building under as-operated conditions should isolate efficiency issues from operations issues. Although a substantial amount of information is needed regarding the features of the building to make this comparison, this is one of the more detailed levels of comparison envisioned.

The overall elements of the benchmarking strategy include:

- Recognize financing and refinancing as important trigger events

  Building financing and refinancing are key trigger events at which time benchmarking could take place. Financing/refinancing occurs periodically throughout the life of a building, starting at time-of-sale and is a time when it is appropriate to consider the operating costs of the building and ways to reduce them. Other trigger events may include benchmarking the building as a condition for leasing of space within the building (see the commercial building leasing strategy). Benchmarking is required as a condition for recognition under the EPA Energy Star® and LEED Existing Building rating programs.

- Benchmarking should be accomplished by utilities through utility bills

  This element would require utilities to benchmark all buildings. This benchmarking would logically take place as part of the utilities' function to provide energy bills. Benchmarking would provide additional information that would allow owners of buildings to compare their building's energy use to similar buildings in the general population as well as comparing the energy consumption of a group of buildings under the same management. This would require the utility to collect enough information about building characteristics (both equipment and usage) to permit these comparisons to be accurately made. A mechanism should be provided for continuous updating of benchmarking scores with each billing cycle or some other timeframe to track the effectiveness/impact of changes in building operations or installation of energy efficiency features.

  Benchmarking also provides a means for utilities to target poorly performing buildings energy audits. Energy efficiency marketing information will also be provided in conjunction with benchmarking to communicate the benefits of further investigation/action and to inform building owners about incentives and services they can obtain from the utilities and other sources.

- Rely on referrals to energy audit programs and to retrofit improvement programs

  Benchmarking alone leads to limited energy savings (perhaps to a change in operating practice based on a consciousness that consumption can be lower). Also, benchmarking can be misleading—if a building scores in a satisfactory range, the building owner or manager can be discouraged from looking deeper and pursuing further potentially cost-effective actions. To motivate further investigation into what may be cost-effective for the individual building, referrals to energy audit programs would be made. This would be followed by appropriate actions to address the problems and opportunities found in the audit. Retro-commissioning would then be undertaken to ensure that the upgrades have been successfully accomplished. Auditors, contractors and commissioning agents would direct owners to a comprehensive solution to improve their benchmarking score.

- Provide energy efficiency marketing information

  With benchmarking, the user of the benchmarking tool would be provided with effective marketing information to encourage further investigation and action to achieve energy efficiency in the building. This information would include the likely benefits of particular measures, avenues to further investigation/action, and identification of additional sources of incentives or information regarding specific actions. Providing this information is an integral part of an overall benchmarking program.

- Periodic benchmarking

  The benchmarking tool would be designed to encourage repeated uses of the tool to track the progress of improvement in the energy efficiency of the building. The benchmarking tool would be designed to facilitate and guide this periodic benchmarking based on updated information about the building's energy consumption, operating practices and energy efficiency features.

Staff received supportive comments regarding benchmarking at its public meeting. The estimated energy savings of 26 gigawatt hours from this strategy means it is sixth out of the ten strategies that were quantified and fifth among the eight where both savings and costs were quantified. This strategy was determined to be cost effective with both the participant and the total resource cost/benefit ratios exceeding one.

This is a major initiative serving as the entry point for other strategies studied under this project for commercial buildings. While providing fewer direct energy savings by itself, referrals to retro-commissioning, audits and existing incentive programs are expected to have a major impact on the efficiency of commercial buildings by increasing participation rates in those programs.

Staff recommends the following:

- The Energy Commission's PIER program should work with the EPA/DOE to improve the Energy Star® tool for California since California buildings already score relatively well compared to other buildings around the country using the tool. Energy Star® is a powerful brand with recognition and momentum in California and should be used, but adjusted to reflect California conditions. If not improved, property owners and managers that currently use Energy Star® to market their properties may resist attempts to make further cost effective energy efficient improvements.

- Utilities should be required to benchmark all commercial buildings. A mechanism should be provided for updating benchmarking scores periodically, such as with each billing cycle, to track the effectiveness/impact of changes in building operations or installation of energy efficiency features. This service should be provided as a component of customer service. Building owners and managers should be involved with refining the benchmarking process.

- The Legislature or Governor should require benchmarking during building financing and refinancing events. Buildings are financed/refinanced periodically throughout their lives. It is appropriate to consider the operating costs of the building and ways to reduce those operating costs during these events.

- The utilities should be required to provide referrals to retro-commissioning and retrofit services for interested customers who have received benchmarking information on their property.

- Utilities should target poorly performing buildings for energy audits and retro-commissioning projects.

- The Energy Commission should work with the Building Owners and Managers Association and the International Facilities Management Association to get benchmarking listed as a best practice for building property management. Enlisting these powerful trade organizations would be very helpful in promoting benchmarking.

- The Flex Your Power campaign should promote benchmarking and follow up services through advertising and marketing materials.

- The Governor should issue a directive to benchmark buildings beyond those which house state government functions, such as CALSTRS and PERS.

Retro-commissioning

This strategy would promote services that can detect and diagnose faults in building systems operations and make changes to correct systems to operate at their expected efficiency. The objective is to place retro-commissioning services, as well as tune-up and operations and maintenance (O&M) services, into the market at key trigger points and on an ongoing basis to maintain building system performance and reduce energy consumption.

Retro-commissioning is recognized among practitioners as a cost-effective strategy. Retro-commissioning programs are often seen in the context of an ongoing or periodic relationship with a customer rather than a one-time, short-term, interaction. Generally, the retro-commissioning process consists of activities that flow logically from benchmarking and energy audits. Retro-commissioning results both in low cost upgrades to building operations and control strategies, replacement of failed components as well as recommendations for larger capital improvements and equipment replacements.

Retro-commissioning involves assessing existing building performance and equipment, often after a major remodel or retrofit or operational enhancement. The efforts start with low-cost operational upgrades where the most cost-effective improvements can be made. This does not mean that equipment upgrades are ignored once the most cost-effective operational measures have been completed.

Elements of a retro-commissioning strategy include:

- Case studies relevant to the commercial building business environment

  The commissioning literature contains case studies that document the costs and benefits of building commissioning. Most of this literature deals with commissioning of government or institutional buildings. Commercial building owners and property managers operate in an environment that is much different from the government or institutional environment. Case studies about commissioning in a commercial building context would be developed that are relevant to commercial building decision makers.

- Develop infrastructure to provide commissioning services

  Developing infrastructure is an important requirement for any commissioning strategy. Few providers offer high level commissioning services. Developing the skills and expertise of commissioning service providers through training is a key element.

- Create demand through incentives and/or tax credits

Although the energy savings potential from commissioning is strong, the market demand for these services is weak. Building managers and occupants for the most part get along fine working in poorly performing buildings and do not see the need for the service. Financial incentives in the form of rebates or tax credits are needed to stimulate market interest.

- Investigate risk issues and highlight case studies in the context of risk management

  Risk management is an important operating principle for many companies. Casting commissioning as a risk management tool rather than strictly an energy savings tool may cause the service to have greater value to the commercial building owner and manager community. Retro-commissioning of buildings helps control risk from volatile energy costs as well as loss of tenants due to comfort issues and risks of litigation stemming from indoor air quality problems.

- Screen customers for retro-commissioning potential

  Not every customer is a good prospect for retro-commissioning. The buildings must have a good combination of technical potential and a management structure that is willing to examine the issue and make decisions. Very old buildings with systems that are near the end of their service life may not make good candidates for operational upgrades. It may not be worth spending money fixing a system that will need to be replaced soon. In that case it might be worth considering equipment system upgrades as part of the building improvement program.

Staff received several comments on this strategy including an ongoing concern that the retro-commissioning industry needs to continue and expand the recommendation and that continuing training is essential. Some utility experience with retro-commissioning indicated that the services can be difficult to sell even when offered at no cost and that owners can also be slow to have the commissioning agents recommendations addressed. These are valid concerns that pose a challenge to successfully pursuing this strategy and the reason that incentives would be offered.

In regard to retro-commissioning of state buildings, the Governor's Green Building Initiative (Executive Order S-20-04) and accompanying Green Building Action Plan requires retro-commissioning of all state buildings over 50,000 square feet with re-commissioning every five years. The California Public Utilities Commission (CPUC) is directed to fund a statewide campaign to inform building owners and operators about building commissioning and ensure that PGC-funded programs include building commissioning. The Energy Commission is directed to develop guidelines and standards for commissioning and that commissioning is incorporated into building standards. The California Public Employees Retirement System (PERS) and the State Teachers Retirement System (STRS) are directed to consider cutting energy use in the California real estate portfolio through retro-commissioning. Case studies on retro-

commissioning that result from the Green Building Initiative would serve as valuable examples for government buildings and businesses as well.

The estimated energy savings of 52 gigawatt hours from this strategy means it is fifth out of the ten that were quantified and fourth among the eight where both savings and costs were quantified. This strategy was determined to be clearly cost effective with the participant cost benefit ratio exceeding three and the total resource cost/benefit ratio exceeding one.

Staff recommends the following:

- The Energy Commission and the California Commissioning Collaborative should investigate commissioning issues and highlight case studies in the context of risk management. Commissioning buildings helps control risk from volatile energy costs, loss of tenants due to comfort issues, and litigation stemming from indoor air quality problems.
- Utilities should screen, or target, customers for retro-commissioning potential using benchmarking information.
- Utilities should provide incentive programs to reduce the cost of commissioning services.
- The Energy Commission should work with the CPUC regarding support for retro-commissioning projects.
- The Energy Commission, utilities and the California Commissioning Collaborative should develop case studies highlighting the costs and benefits of commissioning in the commercial marketplace and present the information to key decision makers in a format that they can understand and use.
- The Energy Commission, utilities and the California Commissioning Collaborative should work together to develop materials for training building operators and commissioning agents to increase awareness and build service capacity in the commissioning industry.
- The Department of General Services, the Energy Commission and Flex Your Power should develop and distribute marketing messages encouraging building owners and managers to have their buildings audited, upgraded, and retro-commissioned.
- Building tenants should consider negotiating upgrade provisions into their lease agreements to obligate building owners and property managers to conduct a retro-commissioning process periodically.

Energy Efficient Commercial Leasing

This strategy focuses on encouraging the use of energy efficiency improvement clauses in commercial leasing contracts. The split incentives that exist in commercial lease agreements where the tenants are responsible for the energy bill so the building owner who must pay for improvements does not receive the reduced bill benefit are a barrier to efficiency program participation. This strategy would develop a standard set of energy efficient leasing agreements that could apply to a wide range of business types. Promotional efforts would place these agreements into the market in a way that causes these lease structures to become an accepted and standard procedure. Leases are generally characterized as:

- Gross leases

  In gross leases the owner pays the energy and other building operating and maintenance costs. Owners therefore pay for and reap the benefits of energy efficiency upgrades to the building. The benefits include improved profitability and net operating income, along with increased property valuation. The owner has no control of the tenant's energy consumption, and is at risk if the tenants operate their space in a manner that causes excessive energy consumption.

- Net leases

  In net leases the tenant pays the energy and other operating costs. This places the owner in the position of the least risk, since the tenants pay the consequences of their energy behavior. The owner however gives up the opportunity for reaping the benefits of efficiency upgrades.

- Fixed base leases

  Existing model leases contain provisions that encourage building owners to make investments in building upgrades and recover these costs from their tenants. The fixed base lease is an arrangement where the owner pays expenses up to a certain fixed amount, and the tenant pays any remaining costs. This provides the incentive for the owner to make efficiency upgrades, while limiting the risk if the tenants cause excessive energy consumption. A tenant cost recovery clause attached to net leases allows the owner to recover the costs of the improvements from the tenant's energy savings with no net increase in the tenant's cost. It is important to make these arrangements known to the parties involved in the commercial leasing transaction and educate owners and tenants about the benefits of energy efficient buildings.

Nonresidential remodeling and renovation is an important opportunity for making energy efficiency upgrades. According to a recent study, in the first half of the 1990s, nearly 25 percent of all construction dollars went for alterations and another 20 percent for additions. The study projected that by 2010 the market for work on existing buildings will be even larger than it will be for new construction. The primary driver for remodeling and

renovation is a change of tenant, or a tenant changing their operations. Most commercial remodeling and renovation is completed in buildings occupied by firms that are leasing space. Working with leasing agents who specialize in commercial lease space may help implementers to identify space that is coming into the market in sufficient time to promote energy efficiency when subsequent changes to space are being made. An important consideration is the understanding of when leases are about to expire, so that new lease arrangements can be negotiated and efficiency upgrades can be planned.

The elements of the commercial leasing strategy include:

- Promote the use of existing model leases

  BOMA has a model lease that can be used as a model for best leasing practices. The BOMA model lease has suggestions for clauses that encourage building owners to upgrade the energy efficiency of their properties. A fixed base lease arrangement could be used for allocating utility costs. Incorporating these provisions into a standard lease template would be encouraged.

- Continuing education

  Content on the advantages of energy efficient buildings and the existence of model lease clauses would be placed into continuing education classes required by the applicable state licensing boards for real estate agents, lawyers, property managers and appraisers. Energy efficiency would represent a module of one of the mandatory classes.

- Actively market the advantages of building energy efficiency

  The advantages of energy efficiency buildings and lease arrangements would be communicated to real estate agents who are in a position to influence the tenant on property selection and lease terms.

- Educate building owners

  Partner networks, such as Energy Star® and LEED would be used to educate building owners about model lease provisions that encourage investments in energy efficiency.

- Incorporate a benchmarking provision into leases

  A provision in the lease should require that the building owner or manager have the building benchmarked at least twice per year or some other time period, and require that the benchmarking data be reported to the tenants. By engaging in the building benchmarking strategy, the building owner will be exposed to a broad range of services through the benchmarking “gateway,” where information on retro-commissioning services and building audits would be available.

Staff has received no comments on this voluntary strategy. The estimated energy savings from this strategy of 4 gigawatt hours means it is tenth out of 10 strategies where energy savings were quantified. The strategy was determined to be cost effective from both participant and total resource cost benefit ratios.

Staff recommends the following:

- The energy efficient leasing strategy should be pilot tested to better quantify the energy savings potential.

- Partner networks should be established, such as Energy Star® and LEED, to educate building owners about model lease provisions that encourage investments in energy efficiency.

- Energy Star® should focus on building tenants. Tenants who participate in the process of efficiency upgrades should be able to gain recognition for their contributions. Currently, the Energy Star® designation is provided to the building owner. Acknowledgement of tenant contributions and duplicate recognition materials such as certificates, plaques, and building registry should be provided.

- BOMA and the Energy Commission should encourage building owners to move away from net leases since energy costs do not show on owner balance sheets and energy efficiency measures in these leases do not positively influence net operating income or building appraisal value. BOMA should offer training to building owners and market the benefits of greater energy efficiency and fixed lease agreements.

- The California Association of Realtors should offer training to realtors regarding the benefits of fixed lease arrangements so they are better able to inform prospective tenants about negotiating efficiency leasing provisions into agreements. Real estate agents are in an important position to influence the tenant on property selection and lease terms.

- Increase the penetration of efficient lease arrangements by making these a component of rating systems such as LEED. It may not be practical to modify leases for all tenants during the building application process, but the rating requirements could offer optional credits for using this type of lease in newly leased space.

- The Department of Real Estate should place content on the advantages of energy efficient buildings and the existence of model lease clauses into continuing education classes required by the applicable state licensing boards for real estate agents, lawyers, property managers and appraisers. Energy efficiency should represent one module of the mandatory classes.

- Tenants should attempt to negotiate with building owners to include a provision in the lease to benchmark the building periodically and disclose the benchmarking data to the tenants.

- The Institute for Market Transformation should develop case studies of commercial properties where fixed based leasing has been successfully used and work with the Flex Your Power campaign to inform building owners of the benefits of energy efficiency.

Energy Efficiency Procurement

This strategy deals with purchasing procedures and standards for energy efficient product specifications conducted by government and non-profit organizations. The Green Building Initiative directs all state agencies that purchase electrical equipment to insure that this equipment is Energy Star® rated where cost effective and that procurement goals minimize energy use, and an effort is underway currently for state government to update its energy efficient procurement program. Staff recommends that these initiatives be aggressively pursued, and that these initiatives consider ways to expand the use of procurement guidelines more widely. California has established purchasing regulations that allow state purchasing contracts to be used by all governmental jurisdictions and nonprofit organizations, creating significant leverage for not only energy but tax dollar savings. The foundation for large-scale energy efficient purchases is in place, it has only to be more effectively used to increase energy savings.

The procurement strategy should be a mandatory approach to provide clear guidance to all state purchasing agents, and should include a funding source. Participation of non-profit and local governments that are eligible to buy off of state contracts would remain voluntary, but would be widely encouraged.

The purchasing function occurs separately among a host of agencies. Different state offices are separately; purchasing the specific products they need. According to interviewees, even different campuses within the university and college systems have their own purchasing staff that acquire products at the campus level. The same applies across the many agencies, boards, and commissions. Likewise, there are thousands of local government agencies in California, all with purchasing staff.

This strategy would start by bringing the purchasing organizations, offices, and staff together into a joint effort to modify purchasing procedures, evaluating products and purchase those technologies that reduce energy demand and save energy. Some offices are already doing this, but many are not because of certain barriers. The effort would need to be adequately structured, funded and placed in operation so that the state can capture the savings. California would need to consider the following program design considerations:

1. Make the program mandatory for state purchasing agencies
    - According to state procurement officials that participated in the public meeting, well-defined mandatory procedures are desirable and welcome by the purchasing agents to eliminate uncertainty in purchasing procedures.
2. Establish a strong central product assessment office that evaluates the energy efficiency of products
    - This would be done using an organization that is already established to provide testing services. The responsibilities of this component would be to produce bid-defensible product evaluations that are grounded in sound analytical processes. Products already being evaluated by other organizations may not need evaluated by this function if the assessment approach is objective and provides reliable results.
3. Ensure that those conducting assessments are qualified
    - These staff must be skilled and knowledgeable about energy efficiency products.
4. Include products related to an energy efficient technology
    - The assessment would not be restricted to technologies that are directly connected to electricity or gas supplies. For example, low temperature laundry detergents can save more energy than high-efficiency washing machines.
5. Allocate sufficient staffing
    - Without sufficient staffing that can bring the product testing results to the thousands of state and local government organizations that could use the information, the likely success of the strategy becomes questionable. Staff would need to be phased in as procurement recommendations and specifications are developed. Staff would also need to visit and make presentations to a significant portion, such as half, of the targeted state and local governments as well as some portion of targeted nonprofit organizations.
6. Establish a statewide communications effort
    - The strategy would need to offer widespread communications on changing products and analyses conducted. Different approaches to communicating the information would be explored. E-newsletters, purchase alert e-grams, presentations and workshops are some options.
7. Provide feedback to participants
    - The strategy would need to provide feedback to participating organizations so they know how much energy they are saving.
8. Make participation easy
    - The strategy would need to employ tactics that are compatible with user needs and timelines, and be user friendly. It should be easy to incorporate purchasing specifications or to support policy decisions with the information developed.
9. Publicize success and case studies

- Success stories should be told within the purchasing community. When organizations save energy they would be recognized for their contributions and stories would be coordinated through procurement associations and related support organizations.

10. Learn from others and past experiences
    - This strategy is not new, but newly resurrected. During the design process, implementers should learn about the experiences of others who have done this before in California and elsewhere.
11. Coordinate, design, and launch with the already established Environmentally Preferable Purchasing Team (EPPT)
    - The EPPT now represents 30 departments within the team structure.
12. Consider placing the implementation branch of the strategy within the procurement offices of the state rather than energy offices of the state.

This initiative would need careful planning and coordination and would need to be given a few years to prove itself.

Statewide purchasing standards and specifications allow energy efficiency to be contract-award criteria. Purchasing decisions are subject to challenges from losing bidders, and procurement staff must be able to defend awards with well justified objective selection criteria. The assessment process must be transparent and the criteria for assessing energy efficiency must be solid. For this reason, the most important aspects of an energy efficient procurement strategy are the standards and specifications on which the bidding process is based.

The strategy must be able to support bid decisions or offer policy guidance that points to a specific type and model of equipment or practice. If done well, the results can be of value to any organization making similar purchases. While the strategy could be established by targeting government and nonprofit sectors, the resulting products may also be adopted by private sector purchasing officials. The potential savings “spillover” from this type of program could be as much or more than the impacts captured in the target market.

The ultimate success of this strategy depends upon participating individuals. Staff was informed that the City of San Francisco has energy efficiency procurement requirements for a few items, but enforcement requires a significant amount of monitoring. For example, individuals may not read all the provisions and still purchase energy inefficient light bulbs. The problem is not significant when the energy efficient item costs less than the traditional product, but when the situation is reversed, some non-complying purchases are inevitable. The existence of procurement requirements does not guarantee compliance since individuals with authority to purchase may disregard the purchasing procedures.

At this time it was not possible to quantify the potential energy savings or costs of this strategy.

RESIDENTIAL AND NONRESIDENTIAL

Demand Response

The demand response strategy seeks to reduce peakload energy use through changes to new time based tariffs, customer education about opportunities for automated controls, and a change of all customers to a new default critical peak pricing rate, with an option to switch back to non-time based tariffs. Demand response refers to customer-side actions taken to reduce energy demand in response to critical peak prices or system reliability signals that are provided by the serving utility. Reliability-based signals are triggered during emergency conditions when the stability of the electrical system is threatened. Market-based signals are triggered during periods of abnormally high electricity prices.

Following the 2001 energy crisis, demand response in California has become an increasingly important policy and program initiative. Demand response can act to reduce and/or shift load from the electrical grid during periods of electrical system instability, and prevent a consequent breakdown of the electric system. The CPUC and the Energy Commission are currently developing a real-time demand-side infrastructure to respond to supply-side problems and prevent further blackouts in California.

There are two parts to demand response, first a signal must be issued that demand response is needed, and second, there must be “technology” in place to respond to the signal. Large potential demand reductions are achievable by using automatically activated technologies that reduce end-use energy consumption as pricing or critical event signals are received. Demand responsive rates offer consumers the incentive to shift load, during peak or emergency times when the price can be several times higher than standard rates.

Market-based demand response programs are also known as price response programs. The single most important factor for market-based programs is customer belief that price change or savings benefits are real. Most programs need some sort of automated response to take full advantage of price changes. A forecast is also needed with enough notice to allow customers without automated devices to take some action. Price forecasts may occur a day ahead and still provide a more accurate real-time pricing (RTP) scheme. The customer must also be aware of the benefits of participation, and if such programs are put in place, customers should receive some form of a validated savings report.

The dynamic nature of pricing in a real-time market causes concern among consumers who are unwilling to adapt to dynamic rates. The unwillingness stems from a number of

sources including a misinterpretation that controls will lead to reduced service or comfort and higher bills. Analysis of pilot participant bills have shown that the average utility bill of 70 percent of customer fell after switching to a time differentiated rate. Lack of operational flexibility is also a real issue of significance for many commercial establishments. Furthermore, for larger corporations, proper hedging options to buy electricity ahead of time may mitigate potential problems and help those businesses that are unable to curtail electricity demand during peak hours. Helping businesses and residents understand the options available to them to permit normal functioning, while also reducing electrical demand is a service that should be facilitated by the demand response strategy.

Rate structures have an important impact on demand response by varying peak and off-peak rates to offer consumers an incentive to shift electric use from peak to off-peak hours. For the rate structure to be effective, consumers must be educated about it and be willing to respond accordingly. Currently, three rate structures have been developed. These are time of use (TOU), critical peak pricing (CPP), and RTP.

TOU rates typically breakdown the rate structure into three time blocks: peak, shoulder, and off-peak with peak at a higher rate and off-peak at a lower rate. The TOU rates are published in advance for an entire season, and cannot adapt to changing weather conditions and grid reliability issues in real-time. CPP occurs only one percent of real-time, and comes into effect a few days a year when energy is expensive or systems are critical or near critical to failure. RTP is the most dynamic solution for rate structure, and provides hourly real-time marginal cost of kWh. RTP is capable of responding to weather conditions, wholesale energy rates, and equipment failures. Both critical peak pricing and real-time pricing rates may use a day ahead notification to allow consumers more response time. Furthermore, CPP may be used in conjunction with either TOU rates to offer stability of rates except during emergency periods.

Currently, the Energy Commission and the CPUC are jointly developing policy relating to rate structure. The vision is for CPP to become the default rate for residential, small commercial, and large customers (less than 200 kW to one MW) and RTP to become the default rate for very large customers (more than 1MW). The shift to CPP and RTP would seek to prevent a breakdown in the electricity network. As noted earlier, consumers need to be educated on the potential financial benefits from a demand response rate structure since many are unwilling to take on the risk of having a higher energy bill.

The key elements of the demand response strategy include:

- Customer education
- Movement toward mandatory participation
- Greater use of automated technology through incentives

Many consumers do not see price response as demand response, even though they are linked. There is also a need to develop demand response programs alongside demand

response pricing to bring out its full effect. Staff supports movement toward a mandatory demand response rate structure. The eventual goal for California should be to have all consumers enrolled in both market-based and reliability-based programs where applicable.

Policy makers also tend to think of energy efficiency and demand response as separate issues. Demand response addresses load reduction during critical time intervals, whereas energy efficiency addresses total energy consumption regardless of time of use. However, for demand response to be most effective, it needs to be tied into energy efficiency measures. Currently, funds from the Public Goods Charge (PGC) are unable to fund demand response programs. Staff supports expanding the scope of PGC funds to allow for technology development and programs for demand response in addition to energy efficiency.

Technology advances enable the use of automated demand response programs by allowing buildings to automatically respond to changes in electric system reliability. The idea is that a control system such as an energy management system (EMS) or energy information system (EIS) can receive signals to shed load and can then execute an automated load shedding schedule/program that turns off or modulates building systems to achieve the desired load reduction. This information can be sent in numerous formats, including price signals via RTP. The signal, in this example a price signal, would be sent from the utility to an EMS or EIS. The EMS or EIS will be able to read the price signal and perform a number of automated building functions such as reduce lighting power, increase thermostat setpoint temperatures, or reprogram chiller activity to operate at a later time. The automated demand response program would ensure that load shedding is occurring during an energy crisis in real-time, and would not be dependent on human involvement.

Although there are currently technologies to support demand response programs, since this is a new field, more enabling technologies need to be developed to support this initiative so demand response may achieve its full potential of curtailing demand during times of crisis. Currently, automated demand response programs have been tested successfully in larger facilities. However, as technology improves, and cost reductions occur in providing and operating automated devices, the scope for these programs should start to include smaller commercial facilities and residences. To take advantage of demand response pricing, enabling technologies must be developed. Some of the technologies include:

- Interval meters with two-way communications capability which allows custom utility bills to reflect the customer's actual usage pattern rather than an "average" load profile for that customer class
- Multiple, user-friendly communication pathways to notify customers of load curtailment events
- Energy information tools that enable near-real-time access to interval load data, analyze load curtailment performance relative to baseline usage, and

provide diagnostics to facility operators on potential loads to target for curtailment

- Demand reduction strategies that are optimized to meet differing high-price or electric system emergency scenarios
- Load controllers and building energy management control systems that are optimized for demand response, and which facilitate automation of load curtailment strategies at the end use level
- End-use equipment that can operate with reduced power and can therefore provide facility HVAC, water heating or other functions during the demand crisis. Storage technologies are well suited to "riding out" and emergency. How these storage technologies can enhance a modern demand response program is an overlooked question that would receive attention in this strategy.
- Onsite generation equipment used with appropriate interconnect devices and controls to meet the needs of the facility under the load curtailment conditions imposed on the facility

There are also several technologies that are currently being researched under the PIER program. These enabling technologies receive a price signal and are able to adjust loads accordingly. For example, the temperature set point for a smart thermostat might vary as a function of the price signal. Staff should further investigate using the building and appliance standards as a way to bring these capabilities into the marketplace. If automated load shedding features are gradually added to appliances, then demand response pricing signals will be more fully used.

Each blackout in California costs consumers and businesses millions of dollars. The importance of demand response is to prevent future blackouts and preserve the reliability of the entire electric system. California should move to a RTP structure that will allow consumers to be more sensitive to real-time energy dynamics and prices. That is, when the electric system is unstable, prices will be high enough for consumers to want to curtail load. For larger facilities, a move toward automated buildings with incentive programs might act as a complementary effort. Incentives may not be needed, since prices that reflect the cost of service should provide the economic incentive to participate. Proper education on the amount of money that may be saved with such automation should be sufficient. As a result, there must be coordination between demand response pricing and demand response measures. As communications, controls and end-use technologies develop to enable demand response benefits to be realized, demand response will become an increasingly powerful tool.

Estimates of energy savings and cost effectiveness for the demand response strategy were not feasible, although the potential for energy savings is considered to be significant. While a mandatory rate structure change would cause 100 percent participation, those interviewed during the AB 549 work suggested that only 50 to 70 percent of consumers would change their load structure since some consumers have an

inelastic load schedule. Even so, experience in California and other states indicates that energy savings from demand response can be impressive. Despite predictions of 260 hours of rolling blackouts, California experienced only one contingency event throughout the summer of 2001. Major contributing factors were the extensive level of peak demand reduction (on the order of 10 percent) resulting from a combination of energy efficiency and demand response programs, voluntary initiatives, increases in electricity rates, and widespread media attention on the state's electricity crisis. On the single curtailment day, approximately 800 MW was curtailed, the majority of which is attributed to the interruptible and direct load control programs of Southern California Edison.

Staff recommends the following:

- The Energy Commission should help form, and work with, a demand response expert panel and identify automated demand response technologies.
- The Energy Commission and the utilities should conduct efforts to educate consumers on real-time pricing and how they can help save the customer money.
- California energy policy should support time-of-use rates for low to medium energy customers and a dynamic real-time pricing structure for large customers.
- The utilities and the Energy Commission should develop incentive programs for demand response enhanced automation technologies.
- The Energy Commission should consider addressing demand response technologies through the building and appliance efficiency standards as a way to bring these capabilities into the marketplace. If automated load shedding features are slowly implemented into appliances, demand response pricing signals will be more fully used.
- Case studies showing the use of demand response without affecting occupant comfort and productivity should be made available. These would include using occupancy sensors, cool storage and other technologies for maintaining the occupied facility conditions within acceptable limits.
- Research should be continued for technologies through PIER and other programs.

Upstream Incentives and Partnerships

There are three features of this strategy: upstream incentives, research and development partnerships, upstream incentives, and technology transfer. Upstream financial incentives for manufacturers or distributors reduce the risk and cost of producing and deploying new energy efficient products. In a well functioning market, expenditures applied to upstream participants to reduce manufacturing/distributor costs are leveraged by avoiding the markups that would otherwise be applied to these costs. Each rebate dollar provided to the manufacturer would be equivalent to reducing the consumer price by perhaps $1.50 to $2.00 after all the markups. By lowering

manufacturing/distributor costs (and end user prices), new energy efficient product sales could be stimulated beyond the current pace.

This strategy also involves developing partnerships between manufacturers, utilities and government to provide information developed through case studies and demonstrations to market products and to continue research and development efforts. The Energy Commission, through its PIER program, and other groups have been sponsoring development projects with manufacturers for several years. Products such as horizontal axis clothes washers, high efficiency heat pumps and furnaces, advanced lighting controls and fixtures and electronic thermostats are a few that were jump-started with research and development funds provided to manufacturers from government or private research management organizations. Funds have been provided for efforts ranging from proof of concept to bench testing to pilot production and field demonstration. Developing effective cost-shared product research and development programs with major manufacturers requires effort, patience and perseverance in getting to know the decision makers in these organizations and developing trust between the manufacturer and the funder.

PIER funds, here helped offset some of the financial risk and opportunity risk of manufacturer's efforts to develop higher efficiency products that will benefit the public at large. The structure of the partnerships has taken on several forms, including cost-shared development projects. Financial arrangements for these partnerships can include an exclusive royalty-bearing license between the manufacturer and funder with a due-diligence clause to protect both parties. Other efforts have included design competitions with a monetary reward or a large purchase order as the prize. Some of these high profile "golden carrot" efforts have succeeded in accelerating the development of much higher efficiency products, such as refrigerators.

While California is a large and lucrative market for some products and manufacturers, and since manufacturers often supply additional market it is desirable to continue efforts to form national partnerships with manufacturers and national research and development organizations to help defray the costs of development and to attract aggressive efforts by prominent manufacturers. National organizations include the U.S Department of Energy (DOE), the Electric Power Research Institute (EPRI), the Gas Technology Institute (GTI) and the Association of State Energy Research and Technology Transfer Institutions (ASERTTI).

Some partnerships of this type are currently underway in PIER program areas, such as those for power supplies, residential and commercial heating, ventilating and air-conditioning, lighting, and controls. The PIER program has the infrastructure in place to continue to look for opportunities to create these partnerships to provide energy efficient products in areas that have high improvement potential and that can also satisfy customer needs. Additional funding is needed to define these opportunities in the areas that have the greatest potential to reduce energy use and peak demand.

A final element of this strategy is technology transfer. One of the main flaws in programs to develop energy efficient products in the past has been a lack of aggressive, continual promotion of the merits of the technology well beyond the initial market introduction of the product. A measured ongoing investment in technology transfer materials that differentiates the advantages of the energy efficient product from its less efficient (and likely lower cost) competitive product, can substantially increase the market penetration of the energy efficient product.

What is needed is a technology transfer effort that extends beyond the completion of the RD&D (research, development and demonstration) for two or more years to ensure that the energy efficient products get a chance to "grow up" before they are overwhelmed by cheaper, otherwise easier to sell less efficient products. It is up to energy efficiency advocates to provide the information and the infrastructure support to make energy efficiency an easy sell. The technology transfer products should be designed to overcome market barriers. What is needed are well designed and presented product directories, case studies, and guidelines for specifying, buying, installing, operating, monitoring, maintaining and servicing the energy efficient products that are developed through this strategy.

The technology transfer materials can be offered through manufacturers and their distribution networks or through industry channels. The upstream products would be designed to mesh with the manufacturer's sales efforts and would be jointly "branded" by the manufacturer and the funders. Joint presentations and meetings would also be encouraged to increase the leverage of the partners in attracting buyers and specifiers to accept the new products.

Purchasing standards and procurement programs can provide a platform that encourages manufacturers to produce energy efficient products in sufficient quantities to ensure that costs can be kept down, while allowing a reasonable profit. Federal, state and local governments should join with utilities and other major organizations to determine reasonable product specifications that can satisfy their needs and will have high enough production volume to provide economies of scale for manufacturers. Purchase contracts for products meeting these specifications can allay much of the tooling and production risk. Getting product volume up and unit cost down will hopefully have the desired effect of lower prices and increased sales volumes, further reducing cost and price. Products such as low-voltage power supplies for consumer electronics, dimmable electronic ballasts, or demand responsive thermostats are well suited to this type of effort. Corollaries of these programs could include design competitions such as the "golden carrot" refrigerator program of the 1990's where manufacturers competed to produce the best product and the winner(s) was guaranteed a reasonable level of sales to offset the research and development costs.

California has been a leader in increasing the energy efficiency of buildings and manufacturers look to California to play a leadership role in bringing energy efficient products to the market and in encouraging their market penetration. Providing better power supplies, space conditioning, appliances, water heating, lighting and demand

response technologies are essential to meet the energy efficiency and demand targets. A well coordinated program of upstream interventions that include product development, manufacturer incentives, market connections that overcome barriers and purchasing support that increases product demand will play a key role.

Staff recommends that this strategy receive further consideration. Some of that consideration could include forming a panel of industry and research and development organizations to prioritize technology development opportunities, examine the energy savings potential of upstream incentives, and identify possible funding streams for this strategy. Candidate products for early consideration could include low voltage external power supplies for consumer electronics, dimmable electronic ballasts for commercial lighting and daylighting applications and demand responsive thermostats for residential and light commercial applications.

Branding

This strategy would develop improved branding options to capture additional energy savings in residential and nonresidential applications. While there is interest in using branding and co-branding to capture additional market share, brands such as Energy Star® may not reflect the most efficient product choices or cover all of the technologies and services needed in California. Energy efficiency branding strategies would focus on the more efficient products and services and will go beyond some of the lower performance levels currently recognized through the Energy Star® brand.

Energy Star® is a widely recognized and successful national brand. However, it can be slow to adopt new products and slow to withdraw a product when more efficient choices are available. Thus, while the Energy Star® brand is an indicator of higher efficiency levels, the Energy Star® program can have limitations to its value as an effective tool for California. Other states and programs have addressed these drawbacks by co-branding approaches or adopting efficiency levels that go beyond Energy Star®. NYSERDA is one state authority that has taken a co-branding approach, with their Energy $mart programs.

In some cases, promoting the Energy Star® brand may not be the best branding approach if the goal is maximizing energy efficiency in California. The question can be: should California move beyond Energy Star® and establish its own program goals and have California programs offer incentives or market only products that meet California's requirements or should California co-brand with Energy Star® focusing only on the products that are the most energy efficient.

In addition to these considerations, there is the problem of moving new products and product configurations into the Energy Star® brand if California elects to stay with that brand. If California pursues its own program goals, then it will have control over these

products and could move more of these products. Likewise, California would be free to create its own approach for providing awareness and for setting standards.

The benefits of a California program are many, but it is very expensive and time consuming. Energy Star® took years to become a brand now recognized by 60 percent of the residential market. Likewise, the federal government spends tens of millions of dollars annually to build and maintain the Energy Star® brand.

Likewise, manufacturers would logically resist efforts for individual states to move toward multiple branding approaches, as product testing and labeling is expensive. Yet, California represents one of the largest economies in the United States and changes in California would most likely influence the product purchasing characteristics of other western states. From this perspective building a more energy efficient branding program for California has great appeal.

It was not possible to quantify the energy savings or cost effectiveness of this alternative strategy. At this time staff believes that decisions about accepting Energy Star® branding, co-branding or setting California-only program requirements should continue to be made on a case-by-case basis.

Information, Case Studies, and Demonstrations

This strategy would establish a centralized function to provide materials needed to overcome information-related market barriers. Elements of the strategy include:

- designing and developing information products to overcome barriers
- developing and executing a plan to get the information to stakeholders

Information products would include fact sheets and brochures, product directories, and guidelines for product design, installation, operation and maintenance. Training materials would be developed including manuals, presentations and videos. Walk-through tours of installations and industry/association meetings would also contribute to the effort.

Market participants tend to favor systems and technologies that have performed well for them in the past. There often exists a substantial resistance to change. Performance information would be needed to overcome this resistance. The best approach would be to provide the participant with examples as similar as practical to the participant's that enable them to endorse the technology. Demonstration projects that provide the desired information may be effective. The information demonstration projects would be documented in case studies and guidelines that permit the new adopter to replicate the success of the demonstration.

Staff at the five utility sponsored energy centers should assist with organizing and promoting pilot training sessions for the energy efficient systems and practices. Product information would be included with curricula for all-day or half-day training sessions. Information from fact sheets, application guidelines, technical papers, and journal articles would be included in the training materials. Walk-through tours at demonstration sites would be arranged, and a "word of mouth" movement would be created by involving opinion leaders and market participants to promote the strategy.

It was not possible to quantify the energy savings or cost effectiveness of this information strategy. The type of information that this strategy recommends be developed is commonly developed as an integral part of individual programs. While partial centralization of information development has merit, staff does not recommend pursuing this strategy as a priority at this time.

Energy Efficiency Technical Training

This strategy for further training of energy auditors, retro-commissioning service providers, whole building performance contractors, property managers, building operators, and real estate professionals to expand energy efficiency assessment skills and knowledge in the market. The strategy should include a certification component to help ensure that technicians and building auditors providing energy services are sufficiently trained to provide these complex, interactive assessments. This will help establish market confidence in high efficiency products and services leading to expanded market demand.

One of the key market barriers to expanding technical energy assessments is the shortage of highly skilled, trained and certified individuals who can perform the technical services. California needs to launch a program that moves more individuals into the energy assessment field. Training must address current assessment technology and a whole building approach.

Financial barriers and time constraints exist that need to be overcome. Likewise, training must be linked to strategies that would build demand for their services so that certified individuals can readily find work. Training institutions will need financial help in providing programs to produce trained and certified experts. A jump start is needed, at least in the short-term, until the training programs become well established and provide clear value to those enrolled in the coursework.

Technical training and certification should focus on retro-commissioning to ensure that those trained understand how to ensure that systems in the buildings work together to achieve savings instead of work against each other. People who are responsible for building operations and maintenance do not usually have the skills to understand buildings from a systems approach. These people work on one piece of equipment at a time. Decision makers often use outside contractors for these services. The outside

contractors are often operating on a “low-bid” mode and get in and out quickly to maximize their profit. As a result, they work on one piece of equipment at a time. Also building owners and operators often do not know that systems are in need of maintenance or that systems may be working against each other. This training and certification strategy would need to focus on educating building owners, managers and operators about energy and non-energy effects of poorly performing buildings and the impact on comfort and energy costs. Training at the residential level would focus on increasing the supply of building performance contractors so they become more widely available and have the skills to assess technology and building level problems.

Several interviewees and panel members indicated that if decision makers know that their buildings can be significantly more energy efficient, more comfortable and safer, there would be increased demand for professionals to do energy efficiency assessments. Several individuals suggested that these professionals need to be certified so there is confidence in the services they provide.

One way to initiate a training and certification effort is by establishing training curricula within technical and community colleges. This would require materials development, equipment purchases, and oversight and monitoring. In the last 30 years schools have moved away from this type of technical training because of the high cost and budget constraints. Relatively, few dollars are needed to equip a room with desks and a whiteboard for teaching math, compared to the extensive costs to purchase and install the variety of HVAC equipment and the testing apparatus that a technical training facility requires. As a result, technical and community colleges have been reluctant to establish energy assessment training. California should consider providing funding resources to assist technical and community college technical training programs.

A statewide training and certification strategy could be initiated for about $20 million dollars a year. Training options include:

- Focus on a building systems approach

  Provide instruction based on a systems approach to energy efficient construction practices and diagnostic techniques. Trainees would thus be made aware of how construction practices affect the efficiency of the buildings, not just the efficiency of parts of the building or of the technologies. Interviewees suggested a systematic buildings program that covers all the basic parts, but ties the results together so that a gain in one place is not lost in another place.

- Provide residential and nonresidential course components

  Small-residential and residential-sized structures behave differently than larger buildings. They have different technology needs and different performance characteristics. Training and experience in residential structure assessment and construction does not equate to providing adequate skills for larger commercial structure assessments or construction, therefore courses would be offered for both.

- Training should be tied to achieving certification

  Interviewees suggested that there needs to be a strong certification program in which contractors that obtain training, or can demonstrate knowledge and skills, can be certified as an energy efficiency professional capable of assessing or installing the most highly efficient equipment. Master Energy Certificates for assessors, installers and builders would be offered. NATE already certifies technicians and can expand to upgrade the process in California. NATE is now getting ready to launch an advanced certification process for HVAC systems that could be applied to California.

Experts agreed that the educational system, as it is currently configured and funded, may not be able to provide these services without financial support. The financial support should be linked to a performance assessment effort that monitors how the funds are spent to ensure that the training is high quality and meets marketplace needs.

Other expert panel participant suggested that HVAC systems are going in without proper setup procedures and suggested that the state establish certification procedures for installers so that installations are done properly. It was noted that many systems are installed or tuned improperly and that effective training and certification is needed to correct these deficiencies.

Several experts noted that performance contractors also need training in whole building assessment techniques. They suggested that it is not enough to focus on single pieces of equipment without an assessment of the interrelated performance of building components. Examples include: duct systems that work against heating or cooling requirements; lighting and other systems that overload space-conditioning equipment; lack of use or ineffective use of untreated or outside air; lost opportunities to use heat recovery when parts of a building need cooling, while other parts need heating; technology selections that work, but are the wrong technology for the building's configuration or use; improperly sized equipment, poor circulation or moisture control that reduces insulation performance or causes health problems.

It is estimated that energy consumption in the typical home or office building can be reduced by 20 to 35 percent if current, cost-effective, readily available technologies are used. However, identifying where the savings can be achieved, and what changes are needed to the building to achieve these savings, requires skilled energy assessors and properly performed retrofits or system adjustments. Providing a way for the labor force to acquire these skills is critical to capturing savings, although it remains difficult to estimate what those savings would be and how to attribute them solely to training. Training is nevertheless an important component of efforts to increase building efficiency.

Elements of this strategy include:

- Develop a central education, training and certification office to coordinate efforts. An organization like the Energy Commission or an independent private sector or

non-profit organization skilled in these approaches would need to champion the effort.

- Engage community colleges, vocational schools, utility education centers, union training programs and professional training institutes to improve the likelihood of success.
- Work with existing trade associations, regulatory agencies and certification programs to insert energy efficiency content into training materials.
- Coordinate this initiative with other efforts that build demand for efficiency programs to avoid mismatches in the number of trained professionals and the demand for services.

Energy Efficiency Risk Protection

When individuals or groups are confronted with choosing any new technology, there is often a tendency to rely on what has worked in the past. This is reinforced when individuals have make choices that have ended in unwanted, or low performing results. When this occurs, they tell others, building even more resistance to change. This risk protection strategy is intended to remove the perceived risk associated with choosing an energy efficiency decision.

This strategy focuses on three participant barriers and two product barriers. Participant barriers include risk avoidance, skepticism about benefits, and institutionalized procedures. The product barriers are reliability uncertainty and performance uncertainty. These barriers can compound one another and limit market movement toward energy efficient choices. These barriers are among the most powerful influences in the market, often outweighing price considerations or payback periods, yet very few programs address them.

Energy professionals are reluctant to enter into the risk assessment and risk protection arena since it is considered part of the insurance industry or the product guarantee and liability fields. As a result, the market is less efficient, and energy efficiency choices are disregarded for the comfort of doing things the way they have always been done.

The risk protection strategy consists of the following elements:

- The formation of a risk assessment capability

  This element would identify the financial risk associated with an energy efficient technology that does not perform to customer expectations. The strategy would need to determine customer expectations and consider those of greatest concern to the customer.

  Research shows that reliability is of great concern. Down time is something to be avoided. Concerns about performance are also critical: Is the product filling the purpose for which it was purchased or is the performance less than needed or expected? Some participants are concerned about whether energy cost savings

will in fact be realized. Assessment of risk can examine the costs associated with the removal or repair of the technology and the cost of purchasing and installing the technology that would have been installed. Also, the assessment can examine the risk of product dissatisfaction, such that the participant would either want the new energy efficient equipment to perform as intended or be removed and alternate equipment placed in operation.

- Identify programs and technologies that can benefit from the risk reduction strategy

  This element would examine the technologies covered in programs and construct a set of technology- and program-specific risk cost estimates that would cover the cost of correcting a poor technology choice.

- Develop cost allocation tables

  Cost allocation tables would influence program design decisions regarding how much of the risk cost should be carried by the strategy and how much by the participant. Options range from 100 percent of the cost of coverage by the strategy using public goods charge or procurement funds (or other funding option), to 100 percent coverage by the participant. If the costs are low, program designers would consider having most or all of the cost covered by the strategy. If cost-effectiveness is significantly harmed, the strategy could offer the risk protection as a value added customer-financed or partially financed option.

- Design the strategy

  Energy program designers and risk protection experts would determine the details of the pilot program design. The pilot program would address operational issues as well as length of coverage issues and how costs would be covered. The strategy would need to consider the following:

  a) Agreements between manufacturers, distributors, and dealers regarding when the manufacturer, the participant or the operating environment is at fault. Arrangements need to be made with these interest groups so that the strategy or customer does not end up paying for technology problems that should be covered by the manufacturer, distributor or dealer.

  b) Criteria for dealing with situations where poorly designed or manufactured technologies have been used that should not have been covered by the program

  c) The length of time the risk protection will be provided

  d) Collaboration with others. There may be other collaborators that would like to join California in designing and testing this new strategy. Possibilities include Wisconsin's Focus on Energy initiatives, New York State Energy Research and Development Authority's (NYSERDA) public benefits program managers, and Vermont's Energy Efficiency Utility.

  e) Team with industry stakeholders who are already in the business or providing product guarantees and liability coverage.

- Design and distribute appropriate materials

Staff received some comments suggesting that the risk being dealt with should not be to cover unrealized energy savings, but situations where other parts of the transaction, unrelated to the equipment, go wrong. Another way to address some of the barriers identified earlier, would be for energy efficiency providers to offer guaranteed energy savings to their customers.

While it is not possible to quantify the energy savings or cost effectiveness of this strategy, there are good reasons to test this concept.

Interagency Program Coordination

California's energy efficiency, demand reduction, and procurement programs have evolved into a mixture of services that can be inconsistent across the state and may be operating without strong cross-program coordination or referral mechanisms. Program participants may often not be provided with information about other programs or energy-related services available to them. These represent lost opportunities to further improve energy efficiency.

At the current time there are several types of energy saving programs actively providing benefits to Californians. Utility programs offer services within each of the investor-owned service territories. Third party programs, including local governments offer services within a single service territory or, more likely, within a small section of a service territory. The Energy Commission also conducts standards programs and loan and grant funding for energy efficiency projects. Industry also conducts initiatives that receive no incentives funding. There is Increasingly good coordination between standards programs and utility programs. There is reasonably good coordination across statewide programs and between utility specific programs and the statewide programs. However, coordination between the third party programs, utility specific and statewide programs and those in the private sector is more limited. It is possible for participants in the third party programs to take advantage of a specific program's offerings without being advised of the statewide, utility, third party or industry efforts that may be of interest to the participant.

If energy programs are not well coordinated with shared promotional materials and presentations of opportunities, substantial opportunities can be missed. For example, when a nonresidential program obtains a participant, that participant is also a residential customer who, at the time of enrollment, acts on behalf of their employer. Yet these participants are seldom provided with information that applies to them as individual customers. Likewise, the residential program participant may be employed by a nonresidential sector business, but the residential customer is seldom provided with information that they can take to their employer for consideration.

Participants in third party programs often may not be provided with the materials that would inform them of other third party, utility, or statewide programs that are available to them. There is no formal way for programs to obtain funding for coordination or to receive credit for participants who are successfully referred to other services. Despite these drawbacks, it should be noted that some interviewees suggested there are enough websites and retail providers in the market that some coordination is already successful.

This interagency coordination strategy focuses on establishing a system that recognizes and rewards information sharing. Program implementation plans need to have an information and coordination component. The coordination strategy would also focus on processes, procedures, and materials that would enable every participating residential or nonresidential customer to be fully informed of other programs and services that are available to them. Participants would then be free to use the information as they see fit. All programs should provide general referral information to customers and participants that not only provide information for the participants, but also their employers and neighbors.

The strategy would include an effort to guide the evaluation planning effort to identify how customers come into programs, and to give a portion of the energy savings credits to the efforts that caused that participation to take place. This is not to say that the energy acquisition, procurement or demand reduction programs should have savings taken away from them, as that would discount the importance of how the savings are achieved. However, this data is needed to drive the portfolio planning efforts. The evaluations should provide a distribution of impact credits to the efforts that caused the impacts to take place. An approach would need to be structured to accomplish this goal, but one way it could be accomplished would be by surveying customers across all evaluation efforts.

In planning a coordination strategy all programs would provide information and referrals with supporting databases and web structured systems and contact tracking systems.

It was not possible to quantify the potential energy savings from this strategy. Staff supports greater interagency program coordination, but does not recommend this as a priority at this time.

CHAPTER 3 — STRATEGY RANKING AND ACTION PLAN

The set of 16 strategies in Chapter 2 were formulated based on their ability to address important trigger events and gaps in existing programs, reduce adoption barriers, build necessary infrastructure and support greater use of energy efficiency measures. While each strategy has value, efforts to gauge the relative significance of one strategy compared to another were undertaken and a ranking order was developed. This was performed to assist policy makers in making decisions regarding possible levels of activities to take for California's future energy efficiency. By investing financial and other resources in these strategies, efficiency will improve and Californians will slow the growth in peakload demand. While the cost of a strategy and its potential to produce energy savings are key features to take into account, many other factors were considered. Estimating the value and then ranking the strategies therefore involved many steps which are described in this chapter. The chapter concludes with a series of recommended action steps to implement options to reduce wasteful energy use.

In assessing the significance of each strategy it became clear that energy savings and costs could not be determined for every strategy. Energy savings for ten of the 16 strategies were estimated, while cost estimates were limited to eight of the 16. Therefore, the strategies were separated into two tables for ranking, those without and those with quantified estimates. Further detail on the methodology and data used to develop the rankings may be found in a technical support document entitled *Technical Assistance in Determining Options for Energy Efficiency in Existing Buildings* and Appendix F of a companion document of the same name.

Energy Savings Potential

The electricity, natural gas, and peak demand savings potential of the strategies considered in this investigation were calculated from a combination of the technology's technical potential to save energy and the strategy's role in increasing the use of the technology. The technical potential calculations follow the model used by Xenergy (2002) for a series of energy potential studies conducted for existing residential and commercial buildings. Technical potential is defined as the energy savings resulting from complete use of all measures in applications where they are deemed technically feasible from an engineering perspective. The technical potential numbers must then be modified based on the anticipated influence of the strategy on market participants.

In estimating the technical potential several factors were considered. These included:

- The existing building stock by building type (numbers of homes for residential or floor area for nonresidential)

- The energy use intensity for the building type
- The end-use savings fraction expected from the technology
- The fraction of the floor space that benefits from the technology
- The fraction of the floor space that is feasible to convert from standard to efficient technology
- The fraction of the floor space that has not been converted to the efficient technology

Data for these factors were taken primarily from the Xenergy Statewide Energy Efficiency Potential Studies for residential and commercial buildings. These data were also supplemented with additional information collected during the research conducted for the AB 549 project.

A list of the technical potential of ten strategies developed for this project is shown in Table 3-1 in order of decreasing electricity savings. This order was followed for all subsequent listings. The details of the savings calculations are described in Appendix F of the consultant's technical support document.

Table 3-1 Technical Energy Savings Potential

Strategy	Gigawatt hours	Megawatts	Million therms	Notes
Upstream Incentives and Partnerships	689	190	0	Based on efficient power supplies and dimming electronic ballasts. 5 year life assumed for power supplies, 10 year churn on commercial space
Whole Building Diagnostic Testing	584	573	250	All owner-occupied residential buildings
Information to All Homeowners	362	121	33	Targeted 10 percent of owner-occupied residential buildings
Retro-commissioning	210	104	17	Targeted 10 percent of commercial buildings
Branding	176	46	62	Appliances, foodservice and office equipment at time of replacement. 20 percent improvement over current Energy Star® levels assumed.
Benchmarking	130	28	2	Implement at refinance, 5 year refinance interval assumed
Disclosure of Residential Time-of-Sale Home Energy Ratings	126	27	9	All pre-1979 single family detached and single family attached buildings at time of sale
Energy Efficient Commercial Leasing	67	13	0	Five year lease renewal, 50 percent of space is on "net" lease
Low Income Multifamily Housing	38	62	5	Annual HVAC tune-ups for all low income multifamily properties, 5 percent major rehabilitation
Residential Equipment Tune-up	31	39	7	Implement at time of sale and equipment replacement; 20 year equipment life
Total	2,413	1,203	386	

The second stage in estimating savings is to account for market adoption rates and the expected speed of adoption for each of these strategies. Customers go through several processes in acquiring and using new technologies from becoming aware of the product to deciding to install it, to confirming that the decision was a good one. The confirmation process is one of the most important, but typically the least considered in implementing energy efficiency programs. If customers are not satisfied with their decisions they will network this dissatisfaction into the market, making it extremely difficult to overcome market resistance. Conversely, if they are satisfied, and the product, provider and performance all are satisfactory, this networking can help substantially speed adoption. How fast a technology is adopted depends to a large degree on its:

- relative advantage over other options, such as favorable initial cost
- compatibility with existing culture and practice
- simplicity
- ability to be tried and tested
- ability to be observed as working properly

Based on these factors and professional judgments, a range of adoption rates were developed representing different scenarios. The results are shown in Table 3-2.

The scenarios are listed in order of increasing adoption, or customer participation, for each strategy. Arriving at the expected energy savings estimates, however, involves a few intricacies. The strategies shown have between three and seven levels of participation and each level indicates a percentage range of adoption. The percentage ranges vary between two and 15 percent, indicating that some scenario results are less understood than others. To calculate the estimate of expected energy savings for each strategy, the most likely scenario, based on program experience and judgment, was selected and that adoption rate was multiplied by the technical savings potential.

The average adoption rates in Table 3-3 represent the midpoint of the most likely scenario range. It should be noted that the most likely scenario was not necessarily the mid level one. Instead, the likely scenario varied from mid level to the highest level of participation. An example of the former would be the Information to All Homeowners strategy. The Residential Equipment Tune-ups assumed the highest level of participation since this strategy has mandatory features. Even so, the mandatory requirements were not viewed as a guarantee of complete compliance, in this case 50 percent participation or compliance was assumed. The same process was used to estimate peak demand and natural gas consumption savings.

Table 3-2 Estimated Market Adoption Rates

Strategy	Incremental Adoption Rate Scenario (Percent of applicable market to adopt*)
Information to All Homeowners	• General information with targeted distribution: 2 - 6 percent • General information widely distributed plus targeted distribution: 6 - 10 percent • General information widely distributed plus targeted distribution and linkages to programs: 10 - 15 percent • General information widely distributed with targeted distribution and linkages to programs that have sector-based one-stop customer solutions: 12 - 25 percent • General information widely distributed plus targeted distribution and pending energy crisis: 15 – 35 percent • General information widely distributed plus targeted distribution and linkages to programs that have sector-based one-stop solutions with pending energy crisis: 40 - 70 percent • General information widely distributed plus targeted distribution and linkages to programs that have sector-based one-stop solutions during and shortly after crisis: 60 - 80 percent
Disclosure of Residential Time-of-Sale Home Energy Ratings	• With aggressive promotion: 10 - 15 percent • With owner or buyer incentives: 12 - 15 percent • With rater incentives: 15 - 20 percent • With very aggressive promotion: 17 - 25 percent • With owner or buyer & rater incentives and very aggressive promotion and education: 35 - 60 percent depending on approach • With real estate agent/broker incentives: add 15 - 20 percent • Only code required after 5 years: 80 - 90 percent
Residential Equipment Tune-up	• Promotion and education: 5 - 10 percent • Aggressive promotion and education with incentives for service provider training: 12 - 20 percent • Aggressive promotion and education with incentives for service provider training and continued more rapid rise in energy costs: 12 - 25 percent • Mandatory at time-of- sale and replacement: 40 - 60 percent
Whole Building Diagnostic Testing	• With general promotion: 2 - 5 percent • With general promotion and education: 3 - 7 percent • With general promotion and education and decrease in insurance rates for actions: 6 - 10 percent • With general promotions and education plus targeted promotions and easy, fast, one-step process: 8 - 12 percent
Low Income Multifamily Housing	• Promotion and education: 5 - 10 percent • Aggressive one-on-one promotions linked to targeted and flexible program services: 10 - 20 percent • Aggressive one-on-one promotions linked to targeted and flexible program services that make actions cost neutral: 17 - 30 percent • Aggressive one-on-one promotions linked to targeted and flexible program services that make actions cost neutral linked with state and federal support and market push: 25 - 60 percent • Aggressive one-on-one promotions linked to targeted and flexible program services that make actions cost neutral linked with state and federal support and market push with rapid approval and payments/credits: 50 - 75 percent • With owner incentives: add 15 percent

Table 3-2 Estimated Market Adoption Rates

Strategy	Incremental Adoption Rate Scenario (Percent of applicable market to adopt*)
Benchmarking	• Promotion and education with benchmarking information program: 3 - 8 percent • Promotion and education with automated benchmarking on monthly bill and coordinated retrofit program services: 8 - 15 percent • Promotion and education with automated benchmarking on monthly bill and one-on-one out-reach that links to attractive program services and incentive programs: 15 - 25 percent
Retro-commissioning	• Promotion and education with information program: 3 - 5 percent • Promotion and education with information programs linked with demonstrations and case studies: 5 - 10 percent • Promotion and education with information programs linked with demonstrations and case studies and targeted benchmarking services: 10 – 20 percent • Promotion and education with information programs linked with demonstrations and case studies and targeted benchmarking services, with trade ally training and incentives: 20 - 30 percent
Energy Efficient Commercial Leasing	• Promotional and information efforts: 2 - 4 percent • Promotional and information efforts with LEED coordination, support and public recognition: 4 - 8 percent • Promotional and information efforts with LEED coordination, support and public recognition with tax exemption: 10 - 20 percent • Promotional and information efforts with LEED coordination, support and public recognition with aggressive tax exemption: 20 - 35 percent
Upstream Incentives and Partnerships	• Establish more partnerships with manufacturers to encourage production of more efficient products: 2 - 5 percent • Establish more partnerships with manufacturers to encourage production of more efficient products linked with longer term promotional efforts: 15 - 25 percent • Establish more partnerships with manufacturers to encourage production of more efficient products linked with longer term promotional efforts and national recognition of achievements in the market place: 25 – 35 percent • Establish more partnerships with manufacturers to encourage production of more efficient products linked with longer term promotional efforts with national recognition of achievements in the market place and financial incentives for production: 35 - 50 percent • Establish national, multi-state, multi-organizational partnerships with manufacturers to encourage production of more efficient products linked with longer term promotional efforts with national recognition of achievements in the market place and financial incentives for production: 65 - 80 percent
Branding	• Continued use of Energy Star® branding (note: already being done): 0 percent • Continued use of Energy Star® Brand when most efficient, with CEE tier 2 when available: 2 - 4 percent • Establish co-brand that improves on Energy Star® for Energy Star® covered technologies, use co-brand on higher efficiency technologies: 4 - 8 percent • Develop a California brand that goes beyond Energy Star® and covers wide range of Energy Star® and non-Energy Star® covered products: 8 - 10 percent • Develop a new national brand in partnership with other states and organizations that goes beyond Energy Star® and covers wide range of Energy Star® and non-Energy Star® covered products, use Energy Star® only when it is not covered by new national brand: 10 - 15 percent

*Based on acquired expert opinions as of May 2005. Assumes statewide market development efforts. Assumes continued multi-year multi-program cycle efforts, consistent funding, consistent service offerings with clear and focused market messages and strategies. Note: Market strategies have interactive effects, that is, markets are affected by multiple events and conditions, adoption estimates are not additive. Market conditions significantly affect estimates. Adoption projections are for efforts started in 2006 running through 2013 to be consistent with CPUC-ED's Public-Goods Charge long-term program objectives.

Table 3-3 Energy Savings Estimates

Strategy	Most Likely Approach	Average Adoption Rate	Gigawatt hours	Megawatts	Million Therms
Upstream Incentives and Partnerships	Establish more partnerships with manufacturers to encourage production of more efficient products linked with longer term promotional efforts for the product lines produced with national recognition of achievements in the market place and financial incentives for production	43 percent	292.8	80.6	0.0
Information to All Homeowners	General information widely distributed with targeted distribution and linkages to programs that have sector-based one-stop customer solutions	19 percent	66.9	22.5	6.2
Disclosure of Residential Time-of-Sale Home Energy Ratings	With owner or buyer & rater incentives and very aggressive promotion and education	48 percent	59.9	13.0	4.3
Whole Building Diagnostic Testing	With general promotions and education plus targeted promotions and easy, fast, one-step process	10 percent	58.4	57.3	2.8
Retro-commissioning	Promotion and education with information programs linked with real demonstrations and case studies and targeted benchmarking services, with trade ally training and incentives	25 percent	52.4	25.9	4.2
Benchmarking	Promotion and education with automated benchmarking on monthly bill and one-on-one out-reach that links to attractive program services and incentive programs	20 percent	26.1	5.6	0.4
Low Income Multifamily Housing	Aggressive one-on-one promotions linked to targeted and flexible program services that make actions cost neutral linked with State and Federal support and market push	43 percent	16.2	26.3	2.3
Residential Equipment Tune-up	Mandatory at TOS and replacement	50 percent	15.3	19.5	3.6
Branding	Establish co-brand that improves on Energy Star® for Energy Star® covered technologies, use co-brand on higher efficiency technologies	6 percent	10.6	2.8	3.7
Energy Efficient Commercial Leasing	Promotional and information efforts with LEED coordination, support and public recognition	6 percent	4.0	0.8	0.0
Total			602.4	254.2	27.5

Cost Effectiveness

Strategy cost-effectiveness was calculated considering the value of the expected energy savings resulting from the strategy and the costs associated with achieving those savings. The value of the energy cost savings were calculated as the net present value[5] of the energy savings over the life of the measures taken. Costs to achieve those savings result from the purchase of the new technology, any administrative costs associated with bringing the strategy into the market and any incentives paid to participants to help reduce market barriers. As noted in the Chapter 1, cost effectiveness was considered from two perspectives: participant cost and total resource cost.

As the term specifies, participant cost effectiveness represents the customer's perspective. It considers energy cost savings resulting from the efficient technology, any incentives paid to the customer to motivate purchase of the technology, and the customer's out-of-pocket expenses. Customers were assumed to act in their best economic interest when considering the purchase of energy efficient technologies; although behavioral research suggests that the decision is complex and involves many uncertainties and non-energy considerations.

The total resource cost-effectiveness includes participant out-of-pocket, incentive, advertising and administrative costs, and the net present value of the utility avoided costs over the life of the measures taken. The avoided costs used in the calculations were computed using the methodology presented in the 2004 avoided cost study conducted by Energy and Environmental Economics (E Three, 2004). The E Three study considers the time dependent nature of avoided costs and the variation in these costs as a function of location. Avoided costs include generation costs, transmission and distribution (T&D) costs, and environmental externalities.

Energy savings, product costs and useful life data were taken primarily from the Xenergy New Construction Potential Studies, along with data compiled during the research efforts of the AB 549 project.

The energy savings potential and cost-effectiveness results for eight strategies are shown in Table 3-4. Details of these calculations can be found in Appendix F of the consultant document. Since many other criteria must still be considered, this listing is not complete. Several elements in evaluating the readiness of the strategy to be placed into the market were also considered. Furthermore, additional difficulty is introduced

[5] Net present value was calculated at a real discount rate of three percent per annum.

because of analytical limits in applying the cost effectiveness criterion to most information strategies.

Table 3-4 Energy Savings Potential and Cost-Effectiveness

Strategy	Gigawatt hours	Megawatts	Million therms	Program Cost ($million)	Participant Benefit Cost Ratio	Total Resource Cost Benefit Cost Ratio
Information to All Homeowners	66.9	22.5	6.2	50.7	1.95	0.83
Disclosure of Residential Time-of-Sale Home Energy Ratings	59.9	13.0	4.3	16.4	2.9	1.2
Whole Building Diagnostic Testing	58.4	57.3	2.8	23.8	1.1	0.6
Retro-commissioning	52.4	25.9	4.2	22.6	3.8	1.7
Benchmarking	26.1	5.6	0.4	1.9	2.5	1.1
Low Income Multifamily Housing	16.2	26.3	2.3	26.6	3.0	1.3
Residential Equipment Tune-up	15.3	19.5	3.6	NA	2.0	1.3
Energy Efficient Commercial Leasing	4.0	0.8	0.0	0.7	4.6	1.9
Total	299.3	170.9	23.8	142.7		

Cost-Effectiveness of Information Strategies

Some of the strategies proposed in this report are designed to stimulate the market by providing information, marketing and education services. These characteristics serve to reduce information-based barriers. It is difficult and, in some cases, inappropriate to attempt to assess the energy savings and cost-effectiveness associated with these types of programs. The Statewide Evaluation Framework states that “if the program has been created primarily as a conduit that leads participants into other programs or services, or it provides training and education on energy efficiency options to customers and other market actors, then the program should not be expected to meet the same cost-effectiveness requirements as programs that are offered expressly as a way of acquiring energy resources.” (Tecmarket Works, 2004). Thus, an analysis of the cost-effectiveness of most of the information only strategies was not undertaken. The exception is the Information to All Homeowners strategy.

Tables 3-5 and 3-6 show the general and measure assumptions used for this information strategy. The analysis assumes measures adopted by homebuyers in the same frequency as the Statewide Residential Audit program operated by the IOUs. Unit energy savings, equipment saturations and costs are taken from the Xenergy Residential Potential Study.

Table 3-5 Information to All Homeowners General Assumptions

Characteristic	Value	Notes
Participants	150,000	33 % of homes targeted, 10 % of these elect to have the audit.
Estimated program cost	$1,751,862	Administration costs
Energy Savings	36.5 GWh	
Participant BCR	6.5	Assumes homebuyer pays for recommended improvements
TRC BCR	0.8	

Table 3-6 Information to All Homeowners Measure Assumptions

Measure Description	Average savings/home (kWh)	Adoption Ratio
Mail audit	171	0.7
Phone audit	257	0.15
In-home audit	611	0.15

Strategy Market Readiness

In addition to energy savings and cost effectiveness, the market readiness of a strategy deserves consideration. The success of a strategy will depend on a certain level of support from policy makers and the marketplace. The following subjective criteria were developed by the consultant team and staff in attempting to account for this factor. These criteria were considered prior to a final ranking of any strategy.

- Existence of regulatory authority

  Strategies considering mandatory regulations will require an authority to issue the regulations and enforce compliance. Strategies that do not fit within the existing regulatory authority of agencies within California state government may require legislation to expand existing regulatory authority.

- Degree of policy maker support

  The degree to which these strategies are in line with policies adopted by the Governor, Legislature, Energy Commission, the CPUC and others will influence the readiness of the strategy.

- Degree of market participant support

  To account for participant support, key market participants were identified, along with their level of influence and perceived level of support. Network diagrams were developed to assess the roles of each market actor and their

relative influence. As an example, Figure 3-1 is the network diagram for the Residential Time-of-Sale strategy. Diagrams for each strategy are included in the consultant report.

- Ability to pay

  Costs to support the strategies will likely be supplied by a combination of state funding, pubic goods charge funding, utility procurement funding and participating customers. The allocation of the costs across these entities and the ability of these entities to bear the costs were assessed.

- Migration path from voluntary to regulatory approach

  Several interviews and expert panels have indicated that an abrupt regulatory approach may not be appropriate for some strategies. A phased approach starting with voluntary use of the strategies moving toward required use may be more appropriate.

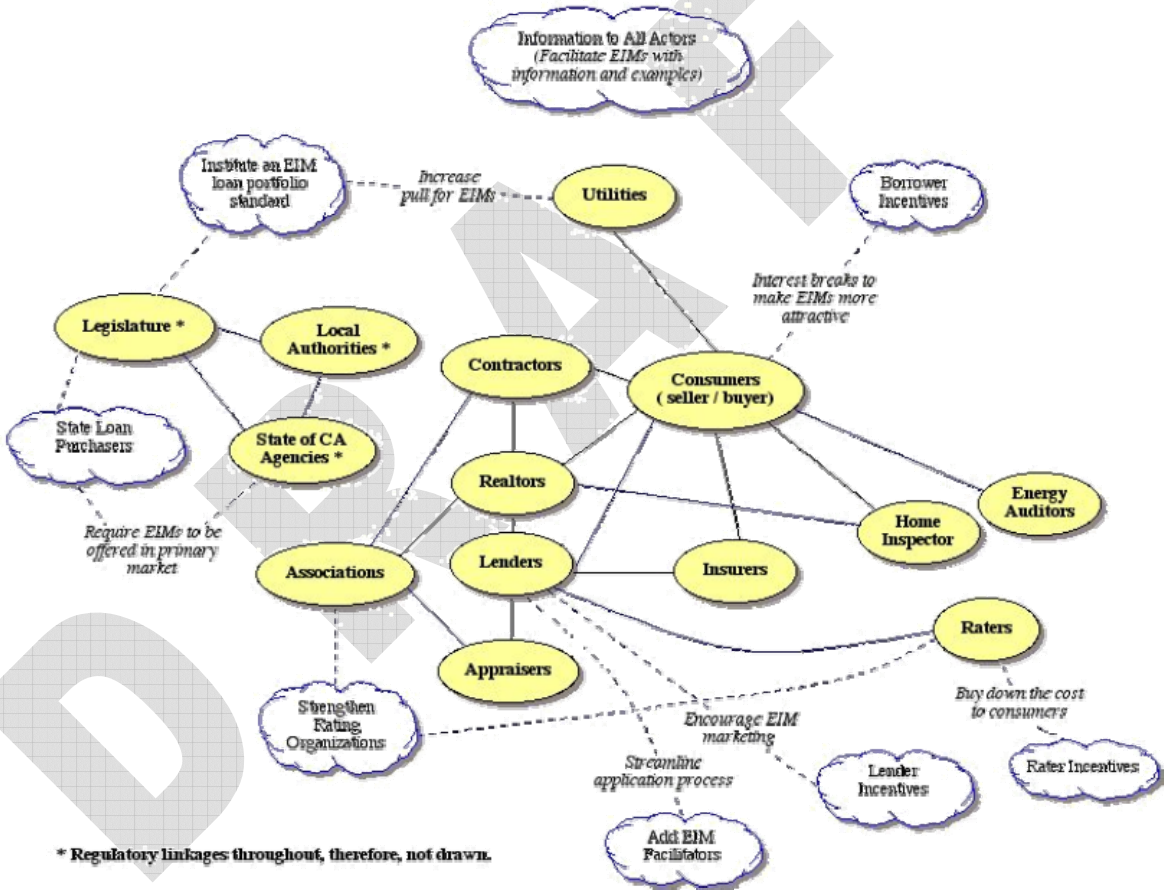

Figure 3-1 Residential Time-of-Sale Network Diagram

Ranking

Strategies were then ranked according to a set of scoring criteria that account for energy and demand benefits, cost effectiveness and the market readiness issues described previously. The ranking criteria and their relative weights are shown in Table 3-7.

Each criterion was assigned a 1 to 4 score, with 1 being the least desirable and 4 the most desirable. Strategies with quantified energy and demand impacts were ranked separately from those without estimated impacts. The scoring for each strategy by category is shown in Tables 3-8 and 3-9.

Table 3-7 Strategy Ranking Criteria and Weights

Category	Weight	Subcategory	Weight within subcategory
Benefits	0.33	Average coincident peak demand savings	0.5
		Lifecycle electricity savings	0.3
		Lifecycle gas savings	0.2
Cost Effectiveness	0.33	Participant cost effectiveness	0.5
		Total resource cost effectiveness	0.5
Market Readiness	0.33	Policy maker support	0.2
		Existence of regulatory authority	0.1
		Market participant support	0.2
		Ability to pay	0.3
		Migration path	0.2

Table 3-8 Strategy Ranking with Estimated Energy Impacts

Strategy	Reg. Authority	Policy Support	Market Support	Able to Pay	Migration Path	KW	KWh	Therms	PT	TRC	Weighted Total
Retro-commissioning	3	4	4	4	2	3	3	2	4	4	3.44
Upstream Incentives and Partnerships	4	3	3	2	4	4	4	1	3	3	3.13
Demand Response	4	4	1	4	4	4	1	1	2	3	2.81
Disclosure of Residential Time-of-Sale Home Energy Ratings	2	4	2	3	3	3	3	2	3	2	2.74
Low Income Multifamily Housing	3	3	3	2	4	2	2	1	3	3	2.57
Commercial Building Benchmarking	3	4	3	4	3	2	2	1	2	2	2.44
Residential HVAC Tune up	2	3	2	3	3	2	2	2	2	3	2.41
Energy Efficient Commercial Leasing	1	2	2	3	1	1	1	1	4	4	2.34
Residential Whole Building Diagnostic Testing	2	3	2	3	3	3	3	4	1	1	2.31
Information to All Homeowners	3	2	2	2	3	3	3	3	2	1	2.27

Table 3-9 Strategy Ranking Without Estimated Energy Impacts

Strategy	Regulatory Authority	Policy Support	Market Support	Ability to Pay	Migration Path	Weighted Total
Energy Efficient Procurement	4	3	3	3	4	3.3
Information, Demonstrations and Case Studies	3	3	3	3	2	2.8
Certification Programs	3	3	3	2	3	2.7
Energy Efficiency Technical Training	2	3	3	2	2	2.4
Interagency Program Coordination	4	3	1	2	3	2.4
Energy Efficiency Risk Protection	3	1	3	1	2	1.8

Considering all the weighted criteria, and for the strategy group where energy savings and cost effectiveness were both estimated, the first rank becomes:

1. Retro-commissioning
2. Disclosure of Residential Time-of-Sale Home Energy Ratings
3. Low Income Multifamily Housing
4. Commercial Building Benchmarking
5. Residential HVAC Tune-up
6. Energy Efficient Commercial Leasing
7. Whole Building Diagnostic Testing
8. Information to All Homeowners

A second ranking can be formed based on adding in those strategies where energy savings could be estimated, but cost effectiveness could not be reasonably determined. The second rank is then:

9. Upstream Incentives and Partnerships
10. Demand Response
11. Branding

The five remaining strategies, where it was not possible to attribute energy savings or determine cost effectiveness, in order of highest to lowest market readiness, are:

12. Energy Efficiency Procurement
13. Information, Case Studies, and Demonstrations
14. Energy Efficiency Technical Training
15. Interagency Program Coordination
16. Energy Efficiency Risk Protection

Strategy Interdependence

While it may seem reasonable to discard strategies 12 through 16 or even nine through 16 from the menu, one last factor to consider is strategy interdependence. For example, training alone would produce few savings in isolation, but this strategy is considered critical to most of the other strategies. Home energy ratings for example would require a build up in the number of qualified personnel and the way that happens is through training. The same can be said for HVAC tune-ups and benchmarking.

Similarly, residential whole building diagnostics, or HVAC tune-ups, or other improvements such as installation of a demand-responsive thermostat, will affect the peak demand of a home and could represent an opportunity for presenting a demand response rate structure to the customer. A home energy rating at the time-of-sale is also connected to the HVAC tune-ups strategy since the recommendations in the rating may be to perform a tune-up. It is also connected to demand response in that a change of ownership at time-of-sale involves a new utility account where the customer could be informed of a demand response electric rate structure. The Information to All strategy has links to at least five of the other strategies.

Because of these linkages and interdependencies staff offers a set of nine recommended strategies to move forward with accomplishing the intent of AB 549. Four additional strategies deserve further consideration and three strategies were dropped from further consideration at this time.

Action Plan

Successful attainment of the strategies described in this report will require action by a number of parties involved in California's energy efficiency community. Defining, assigning and accepting roles and responsibilities of key stakeholders will require significant discussion and negotiation. As a starting point, the main elements associated with each strategy, a proposed candidate organization to take the lead on each element, and the time frame for these activities are provided below for each strategy. This constitutes a proposed plan of action to take what are now concepts on paper and move them into the marketplace. Strategies are listed following the ranking order previously noted.

Retro-commissioning

A range of interest groups are involved in the commercial buildings sector, some actively manage buildings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, or exert influence over equipment choice or facility operation. On the basis of interviews and panel discussions with expert industry observers, as well as a review of

the literature concerning commercial buildings and general supply chain dynamics, the key groups to involve in further discussion are:

- Industry and trade associations such as the Building Owners and Managers Association, the California Commissioning Collaborative and the Building Commissioning Association
- Individual building operators and owners
- Contractors such as HVAC and lighting specialists and commissioning agents
- Energy system designers
- Energy efficiency service providers such as ESCOs, manufacturers, retailers and system integrators
- Efficiency program implementers
- Realtors
- Tenants/Occupants

Table 3-10 outlines the activities, lead/support organization(s) and timeframes to begin the retro-commissioning strategy.

Table 3-10 Action Plan for Retro-commissioning

Activity	Lead Organization/Support Organizations	Timeframe
Form expert panel to guide program development and direction	Energy Commission	2006
Review evaluation and technical reports, conduct assessment and further refine potential savings	Energy Commission/IOUs	2006
Conduct program market demand and participation analysis	Energy Commission/ IOUs /Research Firm	2006
Provide incentive programs	IOUs	2006[1]
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding	Energy Commission/IOUs	2007
Develop case study selection and location criteria	Energy Commission/ IOUs	2007
Develop case studies	Energy Commission/ IOUs/California Commissioning Collaborative	2007
Train commissioning service providers	Energy Commission/ IOUs/California Commissioning Collaborative	2007
Target customers	IOUs	2007
Market program	Flex-your-power and other outreach programs	2008[2]
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2010

[1] Retro-commissioning is likely to be a component of the 2006-2008 IOU program portfolio.

[2] Coordinate with roll out of Benchmarking strategy

Disclosure of Time-of-Sale Home Energy Ratings

A range of interest groups are involved in the residential buildings sector, some occupy and manage dwellings and make decisions about efficiency improvements and investments. Others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literature concerning residential energy use and consumer behavior, the key groups to involve with this strategy are:

- Trade associations connected with real estate transactions, energy services, finance, and training
- Property appraisers
- Energy auditors and raters
- Consumers
- Contractors, general and remodeling specialists, HVAC, electrical and plumbing
- Home inspectors
- Insurers
- Lenders
- State policy makers
- Local governments
- Utilities

Table 3-11 outlines the activities, lead/support organization(s) and timeframes to begin the residential time-of-sale strategy.

Low Income Multifamily

A range of individuals is involved with low income multifamily buildings. On the basis of interviews and panel discussions with expert industry observers the groups to involve in the low income multifamily strategy include:

- State housing agencies, such as the Housing and Finance Agency, the Tax Credit Allocation Committee, the Debt Limit Allocation Committee, and Housing and Community Development
- The U.S. Department of Housing and Urban Development
- Nonprofit and for profit housing developers
- Asset Managers
- Trade associations such as the Affordable Housing Management Association, the Nonprofit Housing Association of Northern California, San Diego Housing Federation, the Southern California Association for Nonprofit Housing, and the California Coalition for Rural Housing

- Public housing staff
- Property managers

Table 3-11 Action Plan for Residential Time of Sale Energy Ratings

Activity	Lead Organization/Support Organizations	Timeframe
Form strategy development group from Energy Commission, industry experts and service implementers	Energy Commission	2006
Conduct market demand and participation analysis; assess baseline practices, market potential and implementation barriers	Energy Commission	2006
Review general feasibility, desirability and potential benefits, barriers and approaches	Energy Commission	2007
Develop technical feasibility and market potential assessments for various implementation approaches	Energy Commission/Contractor	2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding.	Energy Commission	2007
Develop stakeholder group with strong legislative influence that can support effort over a reasonable timeline	Energy Commission	2007
Develop incentive programs	IOUs/Energy Commission	2006-2008[1]
Draft supporting legislation	Energy Commission/Legislature/ Governor	2007-2008
Complete Phase 2 HERS proceeding	Energy Commission	2007
Investigate feasibility of EIM portfolio standard	Energy Commission	2007
Develop EIM partnership program with HUD	Energy Commission/IOUs	2006-2008
Develop and implement realtor training	Energy Commission/California Association of Realtors	2007-2008
Implement EIM portfolio standard with state agencies	Energy Commission	2008
Phase in mandatory ratings	Energy Commission	2007-2009
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2009 Impact 2011

[1]Assumes voluntary time-of-sale incentive program offered during 2006-2008 program cycle
[2]Assumes HUD partnership program offered during 2006-2008 program cycle

Table 3-12 outlines the activities, lead/support organization(s) and timeframes to begin the low income multifamily strategy.

Table 3-12 Action Plan for Low Income Multifamily Housing

Activity	Lead Organization/Support Organizations	Timeframe
Form strategy development group from Energy Commission, industry experts and service implementers	Energy Commission	2006
Review research and form consensus on program design	Energy Commission	2006
Obtain funding to support pilot program	Energy Commission	2007
Design pilot program to address rehabs, assessments of existing buildings and HVAC O&M	Energy Commission	2007
Coordinate with state housing authorities and local low income housing organizations	Energy Commission/Strategy Development Group	2007
Identify areas with planned rehab projects and current buildings in need of upgrades and designate pilot program area	Energy Commission/Strategy Development Group	2007
Provide bill tracking software to prioritize efforts for housing authorities	Energy Commission	2007
Revise utility allowances to encourage efficiency	HUD/Energy Commission	2007
Launch educational and outreach efforts at the local level and work with authorities and owners to select projects	Energy Commission/Strategy Development Group	2007-2008
Provide training and technical education and support to housing authorities	Energy Commission	2008
Provide audits	Energy Commission/Contractor	2008
Provide incentive programs for multifamily projects	IOUs	2009
Implement projects in pilot area	Energy Commission/Strategy Development Group	2008-2010
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2011

Commercial Building Benchmarking

A range of individuals are involved in the commercial buildings sector, some actively manage buildings and make decisions about efficiency improvements and investments, while others provide necessary services, play supporting roles in the network, and exert influence over efficiency choice. On the basis of interviews and panel discussions with expert industry observers, as well as a review of the literature concerning commercial buildings and general supply chain dynamics, the following groups to involve with this strategy are:

- Building owners
- Investors

- Lenders
- Manufacturers
- Energy auditors
- Contractors
- Commissioning agents
- State policy makers
- Nonprofit and government organizations that promote energy conservation and green buildings
- The U.S. EPA/DOE
- Utilities

Table 3-13 outlines the activities, lead/support organization(s) and timeframes to begin the commercial building benchmarking strategy.

Table 3-13 Action Plan for Commercial Building Benchmarking

Activity	Lead Organization/Support Organizations	Timeframe
Form expert panel to guide program development and direction	Energy Commission	2006
Conduct program market demand and participation analysis	Energy Commission/Research Firm	2006
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding	Energy Commission	2007
Work with IOUs to establish benchmarking system for customers using SDG&E's 2007 Home Energy Consumption Tool benchmarking efforts as a potential model	Energy Commission/Expert Panel	2007
Develop benchmarking tool	Energy Commission/PIER	2007
Target customers	IOUs/Energy Commission	2008
Market program	Flex-your-power and other out reach programs	2008
Implement automated benchmarking	IOUs	2008
Refer participants to IOUs for technology help, incentives and on-bill financing	IOUs	2008
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2009

Residential HVAC Tune-up

The principal interests involved in the residential buildings sector are:

- Homeowners and renters
- Contractors
- Energy efficiency service providers
- Training and certification organizations such as community colleges, trade associations and manufacturers
- State policy makers
- Lenders
- Information program providers such as Flex Your Power
- Utilities
- HVAC industry
- Government such as the U.S. Department of Energy, the Consortium for Energy Efficiency (CEE), the New York State Energy Research and Development Authority (NYSERDA), the Florida Solar Energy Center (FSEC) and the Association of State Energy Research and Technology Transfer Institutes (ASERTTI)

Table 3-14 outlines the activities, lead/support organization(s) and timeframes to begin the residential HVAC tune-up strategy.

Energy Efficient Commercial Leasing

The following interest groups participate in the commercial buildings sector and should be involved with the commercial leasing strategy.

- Appraisers
- Associations such as Building Owners and Managers Association (BOMA)
- Building owners, including the State of California and the U.S. government
- Lenders
- Realtors
- Tenants
- Utilities

Table 3-14 Action Plan for Residential HVAC Tune-up

Activity	Lead Organization/Support Organizations	Timeframe
Review evaluation and technical reports; conduct assessment and further refine potential savings	Energy Commission	2006
Conduct program market demand and participation analysis	Energy Commission	2006-2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding.	Energy Commission	2007
Develop stakeholder group with strong legislative influence that can support effort over a reasonable timeline	Energy Commission	2007
Draft supporting legislation	Energy Commission/Legislature/ Governor	2007-2008
Design pilot program development and implementation strategies consistent with funding	Energy Commission	2007-2008
Develop technical training approach for pilot area	Energy Commission/NATE	2008
Design marketing and roll-out approach	Energy Commission/Marketing Firm	2008
Implement technician training and stage the marketing rollout	Energy Commission	2009
Certify technicians	NATE	2009
Rollout initiative in pilot area	Energy Commission/Implementer	2009
Inform and educate consumers	Flex-your-power/IOUs	2009
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2009 Impact 2010
Phase in mandatory requirements	Energy Commission	2011

Table 3-15 outlines the activities, lead/support organization(s) and timeframes to begin the energy efficient commercial leasing strategy.

Table 3-15 Action Plan for Energy Efficient Commercial Leasing

Activity	Lead Organization/Support Organizations	Timeframe
Form stakeholder panel to guide program development and direction	Energy Commission	2006
Review evaluation and technical reports, conduct assessment and further refine potential savings	Energy Commission	2006
Conduct program market demand and participation analysis	Energy Commission/Research Firm	2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding.	Energy Commission/Stakeholder Panel	2007
Develop program design and implementation strategies	Energy Commission/Stakeholder Panel	2008
Identify pilot area to test program concepts	Energy Commission/Stakeholder Panel	2008
Develop case studies	Institute for Market Transformation	2008
Market case study across target pilot area to owners and lease occupants	Energy Commission/Stakeholder Panel	2008
Develop training curriculum	BOMA	2008
Train realtors	California Association of Realtors	2008
Market program	Flex-your-power and other outreach programs	2008
Implement wider program in pilot area	Energy Commission/Stakeholder Panel/Realtors and Lease Holders	2008-2010
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2010

Residential Whole Building Diagnostic Testing

The following key groups have been identified as important to the success of whole building diagnostic testing.

- Trade association, California Building Performance Contractors Association
- Contractors
- News media
- Building science trainers
- Consumers

- Promotion organizations such as Affordable Comfort
- Realtors
- Building officials

Table 3-16 outlines the activities, lead/support organization(s) and timeframes to begin the residential whole building diagnostic testing strategy.

Table 3-16 Action Plan for Whole Building Diagnostic Testing

Activity	Lead Organization/Support Organizations	Timeframe
Review evaluation and technical reports, conduct assessment and further refine potential savings	Energy Commission	2006
Conduct program market demand and participation analysis	Energy Commission/Market research firm	2006-2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding.	Energy Commission	2007
Design program development and implementation strategies consistent with funding	Energy Commission	2007
Review and revise technical training approach	Energy Commission/ California Building Performance Contractors Association (CBPCA).	2007
Investigate valuation of non-energy benefits	CPUC	2007
Engage insurance industry	Energy Commission	2007
Design targeting and marketing approach	Energy Commission/Marketing expert	2008
Train contractors in target area	CBPCA	2008
Market and roll-out program in target area	Energy Commission with Flex-your-power and other outreach efforts	2008
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2009

Information to All Homeowners

The following key groups participate in the residential buildings sector and should be involved with the information to all strategy.

- Building industry and specialty contractor trade groups
- Neighborhood associations
- Consumers
- Contractors
- Home inspectors

- News media
- Efficiency program implementers
- Realtors
- Retailers
- The State of California through the Flex Your Power campaign
- Utilities

Table 3-17 outlines the activities, lead/support organization(s) and timeframes to begin the information to all homeowners strategy.

Upstream Incentives and Partnerships

The upstream incentives strategy would primarily involve manufacturers and distributors. Product manufacturers would be encouraged to produce lower-cost, energy efficient products and develop test procedures, training materials, courses and ratings for the energy efficient products. The strategy would make it easier for distributors and dealers to sell high efficiency products by reducing their cost and providing ancillary materials and support to facilitate sales. The interest groups that would play a role in this upstream strategy are:

- Industry groups and trade associations
- Contractors and equipment specifiers
- Product distributors
- Manufacturers and associations such as the Air-conditioning and Refrigeration Institute, the Commercial Refrigeration Manufacturer's Association, the Association of Home Appliance Manufacturers, the Gas Appliance Manufacturer's Association, the American Society of Heating Refrigerating and Air-Conditioning Engineers, and the Air Conditioning Contractors of America
- Utilities
- Government research and development agencies such as the Energy Commission, DOE, and ASERTTI

Table 3-17 Action Plan for Information to All Homeowners

Activity	Lead Organization/Support Organizations	Timeframe
Form strategy development group from Energy Commission, industry experts and service implementers	Energy Commission	2006
Conduct market demand and participation analysis	Energy Commission/Contractor	2007
Review general feasibility, desirability and potential benefits, barriers and approaches	Energy Commission	2007
Examine current homeowner identification systems and contact approaches and assess their applicability	Energy Commission	2007
Review designs and approaches for baselining homes and identifying priority participants	Energy Commission	2007
Research approaches for developing a coordinated information delivery program that reaches all homeowners and provides covered services and identify design strategies	Energy Commission	2007
Research program cost and cost/benefit potentials for developing strategy under various delivery approaches	Energy Commission	2007
Identify best approaches for information delivery and incorporate into delivery system strategy or devise new system that uses current utility or other means	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding	Energy Commission	2008
Form delivery development team to design and test pilot program consistent with funding capability	Energy Commission/IOU	2008
Establish financing programs, potentially link to On-Bill-Financing Programs	Energy Commission/Selected Implementer	2008
Benchmark residential buildings with the IOUs, using SDG&E's 2007 Home Energy Consumption Tool benchmarking efforts as a potential model	IOU/Energy Commission/Selected Implementer	2009
Target customers	IOUs and Selected Implementer	2009 on
Market services	Selected implementer, linked with Flex-your-power and other out reach and strategy-focused marketing efforts	2009
Implement program	IOUs and/or non-utility program implementers	2009
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2009 Impact 2011

Table 3-18 outlines the activities, lead/support organization(s) and timeframes to begin the upstream incentives and partnerships strategy.

Table 3-18 Action Plan for Upstream Incentives and Partnerships

Activity	Lead Organization/Support Organizations	Timeframe
Form team of stakeholders to guide program development and direction	Energy Commission	2006
Review evaluation and technical reports, conduct assessment and determine potential savings, especially NEEA and NYSERDA	Energy Commission	2006
Identify funding stream for added strategies that supplements the IOU's up-stream efforts[1]	Energy Commission/Governor	2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding	Energy Commission	2007
Design overall implementation strategy and identify funding sources in cooperation with the IOU up-stream strategies for 2007-2009*.	Energy Commission	2007
Prioritize development opportunities	Energy Commission/Program Team/PIER	2008
Develop manufacturer partnerships	Energy Commission/PIER	2008
Develop incentive programs	IOUs	2009
Develop market connections	Energy Commission/PIER	2009
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2009 Impact 2011

[1] Note: for 2007-2009 this is a limited budget, limited focus IOU portfolio program, but it needs to be expanded to address market conditions and needs.

Demand Response

There are several interest groups that are vital to produce the results necessary for demand response in rate structure. They include:

- Governor and California Legislature
- Consumer watchdog groups and low-income advocacy organizations
- State agencies such as the CA ISO, CPUC and the Energy Commission
- Residential and commercial customers
- Industry associations
- Energy raters, auditors, consulting engineers, HVAC contractors, and building control firms
- Utilities
- Manufacturers

Table 3-19 outlines the activities, lead organizations and timeframes to begin the demand response strategy.

Table 3-19 Action Plan for Demand Response

Activity	Lead Organization/Support Organizations	Timeframe
Form statewide panel of demand response experts, CPUC-ED managers, and IOU stakeholders	Energy Commission	2006
Review evaluation and technical reports, conduct assessment and determine potential savings	Energy Commission/Panel	2006
Conduct program market demand and participation analysis	Energy Commission/Research Firm	2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding	Energy Commission/Panel	2007
Implement DR pilot program in selected cities	IOUs	2007
Set metering standards for DR pilot program	CPUC	2007
Develop new pilot program rate structures	IOUs	2007
Develop/identify demand response technologies	Energy Commission/Panel/PIER	2007
Educate consumers	Energy Commission/IOUs	2008
Launch pilot program in at least 3 cities	IOUs	2008
Develop incentive programs for enhanced automation	IOUs/Energy Commission	2009[1]
On going customer satisfaction and use evaluation	Evaluation Firm	2008-2010
Assess success	Energy Commission	2010
Make rates permanent if successful and high customer satisfaction and increasing demand	CPUC	2010
Address demand response capability in appliance standards	Energy Commission	2011
Expand demand response locations and sites	IOUs	2011
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2010 Impact 2012

[1] May be a component of the 2006-2008 IOU program portfolio.

Energy Efficiency Procurement

This strategy would involve a range of groups interested in energy efficiency technology. These include the following.

- Industry groups and trade associations already involved in “green” purchasing
- BOMA, facilities managers associations, purchasing managers associations, schools and local government associations
- Manufacturers and dealers
- Private-sector companies that have strong environmentally friendly purchasing programs
- Utilities
- Government procurement organization, the National Association of State Purchasing Officials
- State government purchasing agents and managers

Table 3-20 outlines the activities, lead/support organization(s) and timeframes to begin the energy efficiency procurement strategy.

Table 3-20 Action Plan for Energy Efficient Procurement

Activity	Lead Organization/Support Organizations	Timeframe
Establish inter-governmental agency working group to set up program concepts	Energy Commission	2006
Conduct program market demand and participation analysis	Energy Commission/Research Firm	2006
Review evaluation and technical reports, conduct assessment and determine potential savings	Energy Commission	2006
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding.	Energy Commission	2007
Design program’s general operational structure	Energy Commission/ Consultant Support	2007
Develop and implement product assessment function plan	Energy Commission	2007
Develop new procurement procedures, set standards and bid specifications, and documentation trail for all findings	Department of General Services in consultation with participating local governments and non-profits	2008
Develop tracking system that meets the needs of participants	DGS/Energy Commission	2008
Develop communications tools and sales force	Department of General Services	2008
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 2009

Energy Efficiency Technical Training

The organizations important to the success of the training strategy include:

- Technical and community colleges

- An oversight organization to further develop the strategy, focus on course needs and to work with other stakeholders to design and launch the strategy and oversee and monitor performance. An organization like the Energy Commission or an independent private sector or nonprofit organization with energy auditing, installation, education and assessment experience are possible candidates.
- Certifying organizations, such as colleges that provide the training, via state agencies that handle licensing or via nonprofit organizations that specialize in certification programs, such as NATE and ACCA
- Utilities
- Realtors
- Assessors
- Industry associations and trade groups for training, testing and certification standards
- Building owners, managers and operators
- Residential and nonresidential equipment suppliers
- Contractors
- Consumers
- Energy efficiency service providers
- Local governments
- Manufacturers, distributors and retailers
- Trainers
- Utilities

Table 3-21 outlines the activities, lead/support organization(s) and timeframes to begin the technical training strategy.

Table 3-21 Action Plan for Energy Efficiency Technical Training

Activity	Lead Organization/Support Organizations	Timeframe
Establish stakeholder group with interested parties, including certifying organizations (e.g. NATE, CAR), service industry, educational institutions, state organizations, IOUs, CPUC and others to assess and identify specific needs and funding requirements	Energy Commission	2006
Identify funding source for training efforts	Energy Commission/Legislature/Governor	2007
Identify where certification is needed to help the industry obtain energy efficiency goals	Energy Commission	2007
Develop central training and certification office	Energy Commission	2007
Interface with existing training service providers	Energy Commission	2007
Develop curriculum development plan	Energy Commission /California Community Colleges Chancellor's Office	2008
Establish grant program to offset program development and participant tuition costs	Energy Commission	2009
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2008 Impact 20010

Energy Efficiency Risk Protection

The following groups should play a role in advancing the risk protection strategy.

- Policy makers may need to change policy provisions so that such a service can be allowed under the current program design
- Lawmakers should be consulted to determine how this strategy fits into current product liability and performance laws
- Utilities and third-party providers
- Manufacturers, distributors, dealers and retailers
- Contractors
- Industry and trade associations who are already involved in industry product support services
- Energy program policy and design professionals in other states who may wish to join in the pilot program development and testing

Table 3-22 outlines the activities, lead/support organization(s) and timeframes to begin the energy efficiency risk protection strategy.

Table 3-22 Action Plan for Efficiency Risk Protection

Activity	Lead Organization/Support Organizations	Timeframe
Identify markets and measures in which performance uncertainty, and reliability are key market barriers	Energy Commission/Research Firm	2006
Conduct program market demand and participation analysis	Energy Commission/Research Firm	2007
Assess cost structure and shared cost arrangements needed to successfully develop and deploy a protection strategy.	Energy Commission/Research Firm	2007
Conduct risk assessment	Energy Commission/Research Firm	2007
Work with manufacturers and guaranteed coverage market to assess feasibility of program	Energy Commission	2007
Develop program design and funding requirements	Energy Commission	2007
Conduct strategy go/no-go decision criteria and make decision based on criteria and available funding.	Energy Commission	2007
Identify and prioritize opportunities	Energy Commission/Research Firm	2007
Develop cost tables and pricing structures with incentives to offset additional costs	Energy Commission/IOUs/CPUC	2008
Develop pilot programs	Energy Commission/IOUs/CPUC	2009
If successful, ramp-up and integrate with IOU and other programs	Energy Commission/IOUs	2013
Evaluate program and modify to improve, continue or eliminate	Evaluation Firm	Process 2009 Impact 2012